THE

# SCHOOLMASTER'S ASSISTANT,

BEING A

# COMPENDIUM OF ARITHMETIC,

BOTH

*Practical and Theoretical.*

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## IN FIVE PARTS.

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CONTAINING

I. Arithmetic in whole Numbers, wherein all the common Rules, having each of them a ſufficient Number of Queſtions, with their anſwers, are methodically and briefly handled.

II. Vulgar Fractions, wherein ſeveral Things not commonly met with, are there diſtinctly treated of, and laid down in the moſt plain and eaſy manner.

III. Decimals, in which, among other Things, are conſidered the Extraction of Roots, Intereſt, both Simple and Compound: Annuities; Rebate, and equation of Payments.

IV. A large collection of Queſtions with their Anſwers, ſerving to exerciſe the foregoing Rules, together with a few others, both pleaſant and diverting.

V. Duodecimals, commonly called Croſs Multiplication; wherein that Sort of Arithmetic is thoroughly conſidered, and rendered very plain and eaſy; together with the method of proving all the foregoing operations at once by Diviſion of ſeveral Denominations, without reducing them into the loweſt Terms mentioned.

The whole being delivered in the moſt familiar way of Queſtion and Anſwer, is recommended by ſeveral eminent Mathematicians, Accomptants and Schoolmaſters, as neceſſary to be uſed in Schools by all teachers, who would have their Scholars thoroughly underſtand, and make a quick progreſs in ARITHMETIC.

To which is prefixed, an ESSAY on the Education of YOUTH; humbly offered to the conſideration of PARENTS.

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*A NEW EDITION.*

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## BY THOMAS DILWORTH.

Author of the New Guide to the Engliſh Tongue, Young Bookkeeper's Assistant, &c. and Schoolmaster in Wapping.

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*All things, which from the very original Being of Things, have been framed and made, do appear to be framed by the Reaſon of number; for this was the principal Example or Pattern in the Mind of the Creator.*

AN. BOETIUS.

*Thou, (O Lord) haſt ordered all Things in Meaſure, Number and Weight.*

WISDOM xi. 2.

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AIR:
PRINTED BY J. & P. WILSON.

1800.

1607/6177.

BRITISH MUSEUM
30 NOV 73

AN

# ESSAY

ON THE

# EDUCATION OF YOUTH,

HUMBLY OFFERED TO

# THE CONSIDERATION OF PARENTS.

THE right education of children is a thing of the higheſt importance both to themſelves and the Commonwealth. It is this which is the natural means of preſerving religion and virtue in the world; and the earlier good inſtructions are given, the more laſting will be the impreſſion; for it is as unnatural to deny theſe to children, as it would be to withhold from them their neceſſary ſubſiſtence. And happy are thoſe, who, by a religious education and watchful care of their parents, their wiſe precepts and good examples, have contracted ſuch a love of virtue and hatred of vice, as to be removed out of the way of temptations. And it is owing to the want of this education that many, when they leave their ſchools, do not prove ſo well qualified as might be expected. This great omiſſion, being, for the moſt part, chargeable on the parents, I hope the following particulars (which are the common voice of our profeſſion) will not be taken amiſs. And,

1. A conſtant attendance at ſchool is one main axis whereon the great wheel of education turns. Therefore, if that obſervation which is commonly made by parents, be true, that the maſters have holidays enough of their own making, there is, by their own confeſſion, no neceſſity for them to make an addition.

2. Parents ſhould never let their own commands run counter to the maſter's, but whatever taſk he impoſes on his pupils, to be done at home, they ſhould be careful to have it performed in the beſt manner, in order to keep them out of idleneſs. "For vacant hours move on heavily, and drag ruſt and filth along with them; and it is full employment and a cloſe application to buſineſs, that is the only barrier to keep out the enemy, and ſave the future man*."

3. Parents themſelves ſhould endeavour to be ſenſible of their children's defects and want of parts; and not blame the maſter for neglect,

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* Watt's Eſſays.

when his greateſt ſkill, with ſome, will produce but a ſmall ſhare of improvement. But the great misfortune is, as the proverb expreſſes it; Every bird thinks her own young the faireſt; and the tender mother, though her ſon be of an ungovernable temper, will not ſcruple to ſay, He is a meek child, and will do more with a word than a blow, when neither words nor blows are available. On the other hand, ſome children are of a very dull and heavy diſpoſition; and are a long time in gathering but a little learning, and yet their parents think them as capable of inſtruction as thoſe who have the moſt bright and promiſing parts; and when it happens that they improve but ſlowly, though it be in proportion to their own abilities, they are hurried about from ſchool to ſchool, till at laſt they loſe that ſhare of learning, which otherwiſe, by ſtaying at the ſame ſchool, they might have been maſters of. Juſt like a ſick, but impatient man, who employs a phyſician to cure him of his malady; and then, becauſe the diſtemper requires time as well as ſkill to procure his health, tells him, "He has all along taken a wrong method," turns him off, and then applies to another, whom he ſerves in the ſame manner: and ſo proceeds till the diſtemper proves incurable.

4. It is highly neceſſary that children ſhould be early made ſenſible of the ſcandal of telling a lie: To this end parents muſt inculcate upon them betimes, that moſt neceſſary virtue of ſpeaking truth, as one of the beſt and ſtrongeſt bands of human ſociety and commerce, and the foundation of all moral honeſty.

5. In juſtice (I mean the tricking each other in trifles, which ſo frequently happens among children, and is very often countenanced by the parents, and looked on as the ſign of a very promiſing genius) ought to be diſcouraged betimes, leſt it ſhould betray them into that vile ſin of pilfering and purloining in their riper years; to which the grand enemy of mankind is not wanting to prompt them by his ſuggeſtions, whenever he finds their inclinations have a tendency that way.

6. Immoderate anger and deſire of revenge, muſt never be ſuffered to take root in children. For (as a moſt Reverend divine obſerves [†]) "If any of theſe be cheriſhed, or even let alone in them, they will, in a ſhort time, grow headſtrong and unruly; and when they come to be men, will corrupt the judgement, turn good nature into ill humour, and underſtanding into prejudice and wilfulneſs"

7. Children are very apt to ſay at home what they ſee and hear at ſchool, and often times more than is true; ſome parents, as often, are weak enough to believe it. Hence ariſes thoſe great uneaſineſſes between the parents and the maſter, which ſometimes are carried ſo high, as for the parent, in the preſence of the child, to reproach him with hard names, and perhaps with more abuſive language. On the contrary,

8. If parents would have their children improve in their learning, they muſt cauſe them to ſubmit to the little (imaginary) hardſhips of the ſchool, and ſupport them under them by ſuitable encouragements. They ſhould not fall out with the maſter upon every idle tale, nor even give their children the liberty of expreſſing themſelves that way, but they ſhould by all means inform them frequently, "That they ought to be good boys, and learn their book, and always do as their maſter bids them; and that if they do not, they muſt undergo the pain of correction." And it is very obſervable what a harmony there is between the maſter and the ſcholar, when the latter is taught to love and have

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[†] Abp. TILLOTSON.

a good opinion of the former; and then, “ With what eaſe does the “ ſcholar learn? With what pleaſure does the maſter communicate!”

9. The laſt thing that I ſhall take notice of is, That while the maſter endeavours to keep peace, good harmony and friendſhip among his ſcholars, they are generally taught the reverſe at home. “ It is indeed “ but too common for children to encourage one another, and be en- “ couraged by their friends in that ſavage and brutiſh way of contention, “ and count it a hopeful ſign of *mettle* in them to give the *laſt blow*, if “ not the firſt, whenever they are provoked; forgetting at the ſame time, “ that to teach children betimes to love and be good-natured to others, “ is to lay early the true foundation of an honeſt man. Add to this, that “ cruel delight which ſome are ſeen to take in tormenting and worrying “ ſuch poor animals and inſects as have the misfortune to fall into their “ hands. But children ſhould not only be reſtrained from ſuch barbarous “ diverſion, but ſhould be bred up from the beginning to an abhorrence of “ them *,” and at the ſame time be taught that great rule of humanity, “ To do to others as we would they ſhould do to us.

From what has been ſaid relating to the management of children at home, the neceſſity of the parents joining hands with the ſchoolmaſter appears very evidently. For when the maſter commands his pupils to employ their leiſure time in getting ſome neceſſary parts of learning, their friends ſhould not command them to forbear: And when they ought to be at ſchool at the ſtated hours, they ſhould not be ſent an hour or two after, in the time of health, ſometimes with a lie in their lips, to excuſe their tardineſs, and ſometimes with an order, and a brazen front, to tell their maſter, their friends think it time enough to come to ſchool at nine in the morning, becauſe the weather is a little cold, or becauſe they muſt have their breakfaſt firſt. I ſay parents ſhould not act ſo indiſcreetly, becauſe it clips the wings of the maſter's authority: It makes boys firſt deſpiſe and undervalue their teachers, and then become unmannerly and impertinent to them; correction for which makes the tutor hated by the children, and then there naturally follows either a total diſregard to buſineſs, or a general careleſſneſs in every thing they do. And,

While I am ſpeaking of the education of children, I hope I ſhall be forgiven, if I drop a word or two relating to the fair ſex—It is a grand remark, that they are ſo unhappy as ſeldom to be found either to ſpell, write, or cypher well: and the reaſon is very obvious, becauſe they do not ſtay at their writing ſchools long enough. A year's education in writing is, by many, thought enough for girls; and by others it is thought time enough to put them to it when they are eighteen or twenty years of age; whereas, by ſad experience, both theſe are found to be, the one too ſhort a time, and the other too late. The firſt is a time too ſhort, becauſe when they are taken from the writing ſchool, they generally forget what they learnt, for want of practice; and the other too late, becauſe then they are apt to look too forward, imagine all things will come of themſelves without any trouble, and think they can learn a great deal in a little time; and when they find they cannot compaſs their ends ſo ſoon as they would, then every little difficulty diſcourages them: And hence it is, that adult perſons ſeldom improve in the firſt principles of learning ſo faſt as younger ones. For a proof of this, I appeal to every woman whether I am juſt in my ſentiments or not. The woman who has had a liberal education this way, knows the advantages that ariſe from the ready uſe of the pen; and the woman who has learnt little or nothing of it, cannot but lament the want of it. Girls therefore ought to be put to the writing ſchool as early as boys, and continued in it as long, and then it may reaſonably be expected that both ſexes ſhould be alike ready at their pen. But for want of this, how often do we ſee women, when they are left to ſhift for themſelves in the melancholy ſtate of widowhood (and what woman knows that ſhe ſhall not be left in the like ſtate?) obliged to leave their buſineſs to the management of others; ſometimes to their great loſs and ſometimes to their utter ruin; when on the contrary, had they been ready at their pen, could ſpell well, and underſtand figures, they might not only have ſaved themſelves from ruin, but perhaps have been miſtreſſes of good fortunes. Hence then may be drawn the following, but moſt natural concluſion, viz. "The education of youth is of ſuch vaſt importance, "and of ſuch ſingular uſe in the ſcene of life, that it viſibly carries its "own recommendation along with it: For on it, in a great meaſure, "depends all that we hope to be; every perfection that a generous and "well-diſpoſed mind would gladly arrive at. It is that that ſtamps the "diſtinction of mankind, and renders one man preferable to another; "is almoſt the very capacity of doing well; and remarkably adorns every "point of life †." And as the great end of human learning is to teach a man to know himſelf, and thereby fit him for the kingdom of heaven: So he that knows moſt, conſequently is enabled to practiſe the beſt, and become an example to thoſe who know but little, or are quite ignorant of their duty.

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* TALBOT's Chriſtian Schoolmaſter.

I am,

Your and your children's well-wiſher,

THOMAS DILWORTH.

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† WATT's Eſſay.

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## *The Explication of ſome* Marks *uſed in this* COMPENDIUM.

= TWO parallel lines are the marks of Equality; as 12 *oz.* = 1 *lb.* ſignifies that 12 ounces are equal to 1 pound.

+ Saint George's croſs ſignifies more, or Addition; as $4+2=6$; *i. e.* 4 more 2, are equal to 6.

— A ſtraight line ſignifies leſs, or Subtraction; as $4-2=2$; *i. e.* 4 leſs 2, are equal to 2.

× Saint Andrew's croſs denotes Multiplication; as $4\times2=8$; *i. e.* 4 multiplied by 2, are *equal* to 8.

÷ ∺ A line between two points, or between 4 points, is the ſign of Diviſion; as $4\div2$ or ∺2=2; *i. e.* 4 divided by 2, are equal to 2.

)( The reverſed Parentheſes denote Diviſion alſo; as, 2)4(2; *i. e.* 4 divided by 2, are equal to 2.

$4\,\frac{7\,6}{3\,2}\,1$ Numbers placed in a fraction-like manner, do likewiſe denote diviſion; the lower number being the Diviſor, and the upper number the dividend.

∷ Four points, ſet in the middle of four numbers, denote them to be proportioned to one another by the Rule of Three; as 2 : 4 ∷ 8 : 16; that is, as 2 is to 4, ſo is 8 to 16.

N. B. Some maſters, inſtead of points, uſe long ſtrokes to keep the terms ſeparate, but it is wrong to do ſo; for the two points between the firſt and ſecond terms, and alſo between the third and fourth terms, ſhew that the two firſt and the two laſt terms are in the ſame proportion. And whereas four points are put between the ſecond and third terms, they ſerve to disjoin them, and ſhew that the ſecond and third, and firſt and fourth terms, are not in the ſame direct proportion to each other as are theſe before mentioned.

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# *The Explication of ſome* Marks *uſed in this* COMPENDIUM.

= TWO parallel lines are the marks of Equality; as 12 *oz.* = 1 *lb.* ſignifies that 12 ounces are equal to 1 pound.

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*Money.*

| | |
|---|---|
| *£.* | Libræ, Pounds. |
| *S.* | Solidi, Shillings. |
| *D.* | Denarii, Pence. |
| *Qrs.* | Quadrantes, Farthings. |

$\overline{2+3}\times5=25$, Signifies that the ſum of 2 and 3 multiplied by 5, is equal to 25.

$\overline{3-2}\times5=5$, Signifies that the difference between 3 and 2, multiplied by 5, is equal to 5.

$\surd$ or $\surd\,q$. Prefixt to any number, ſuppoſes that the ſquare root of that number is required. Sometimes it is the ſign of irrationality, and ſignifies that the ſquare-root of ſuch a number can never be truly found.

$\overset{3}{\surd}\,c$ Prefixt to any number, ſuppoſes that the cube-root of that number is required. Sometimes it is the ſign of irrationality and ſignifies that the cube-root of ſuch a number can never be truly found.

$3aa+3a$, Signifies 3 times the ſquare of *a*, more 3 times *a*.

$3aae+3eea+eee$, Signifies 3 times the ſquare of *a*, multiplied by *e*, more 3 times the ſquare of *e*, multiplied by *a*, more the cube of *e*, as in the cube-root.

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# THE
# SCHOOLMASTER'S ASSISTANT.

## PART I.

## Of Arithmetic in Whole Numbers.

### INTRODUCTION.

### *Of* Arithmetic *in general.*

Q. WHAT is Arithmetic?

A. Arithmetic is the art or ſcience of computing by numbers, either whole or in fractions.

Q. What is Number?

A. Number is one or more quantities, anſwering to the queſtion, How many?

Q. What is Arithmetic in Whole Numbers?

A. Arithmetic in Whole Numbers, or Integers, ſuppoſes its numbers to be entire quantities, and not divided into parts.

Q. What is Arithmetic in Fractions?

A. Arithmetic in Fractions ſuppoſes its numbers to be the parts of ſome entire quantity.

Q. How do you conſider Arithmetic with regard to art and ſcience?

A. Both in theory and practice.

Q. What is Theoretical Arithmetic?

A. Theoretical Arithmetic conſiders the nature and quality of numbers, and demonſtrates the reaſon of practical operations. And in this ſenſe Arithmetic is a ſcience.

Q. What is Practical Arithmetic?

A. Practical Arithmetic is that which ſhews the method of working by numbers, ſo as may be moſt uſeful and expeditious for buſineſs. And in this ſenſe Arithmetic is an Art.

Q. What is the nature of all Arithmetical Operations?

A. The nature of all Arithmetical Operations is, by ſome quantities that are given, to find out others that are required.

Q. Which are the Fundamental Rules in Arithmetic?

A. Theſe five: Notation, Addition, Subtraction, Multiplication, and Diviſion.

# OF NOTATION.

Q. WHAT is Notation ?

A. It is the Art of expreſſing Numbers by certain characters or figures.

Q. What is the uſe of Notation ?

A. Notation teaches us to read and write numbers by their true value ?

Q How many ſorts of Characters or Figures are numbers uſually expreſſed by ?

A. Two, *viz.* The Arabic Figures, and the Latin Letters.

Q. How are the Arabic Figures expreſſed ?

A. The Arabic Figures are thus expreſſed; One 1, Two 2, Three 3, Four 4, Five 5, Six 6, Seven 7, Eight 8, Nine 9, Nought or Cypher 0. And this is the Notation or reading and writing of every ſingle figure.

Q. How far may the uſe of theſe Figures be extended ?

A. Theſe ten Characters or Figures may be uſed to expreſs all manner of numbers, from the leaſt to the greateſt, that can be conceived ; even without end.

Q. How many Figures are ſufficient to expreſs moſt ordinary concerns ?

A. Nine ; and therefore the table of Notation commonly extends no farther than to nine places.

Q. Why does it conſiſt of nine places rather than of eight or ten ?

A. Becauſe they make up three even Periods.

Q. What do you mean by a Period ?

A. A Period is a quantity expreſſed by three figures, whereof the firſt to the right hand ſignifies ſo many units or ſingle things ; the ſecond ſo many tens ; and the third ſo many hundreds.

Q Why are three figures called a Period ?

A. Becauſe if the number be increaſed above three places, there is ſtill the ſame periodical return of the value of thoſe places, and every third figure to the left hand will always be hundreds, if it be ever ſo far extended.

Q. Is a Unit, or one, a Number ?

A. A Unit is a Number, becauſe it may properly anſwer the queſtion, How many ?

Q. Give an example or two ?

A. How many Gods do we believe ? the anſwer is, One. How many Sundays in the compaſs of a week ? Anſ. One.

Q. In what nature, or proportion of value, do Numbers increaſe from the Unit's place to the left hand ?

A. By Tens.

B M

Q. How muſt they be read?

A. From the left to the right hand.

Q. If two figures are given to be read together, how muſt they be valued?

A. The firſt Figure towards the right hand is Units, and the next to that is ſo many Tens; as 89, Eighty-nine. Where 9 is in the place of Units, and 8 is in the place of Tens; for 8 tens are properly called Eighty.

Q. If three figures or a whole Period be given, how is it to be valued?

A. Beginning at the laſt figure on the right hand, I value them Units, Tens, Hundreds; as 789, ſeven hundred and eighty-nine.

Note 1. As every third Figure from the place of Units, bears the name of Hundreds: So for any great ſum to be diſtinguiſhed into Periods (as in the following tables) will be of good uſe to the learner, in the eaſier valuing and expreſſing that ſum.

2. There is alſo another ſort of Periods, which ſome diſtinguiſh thus, viz. Millions, Millions of Millions, &c. and others thus, viz. Millions, Billions, Trillions, &c. each Period conſiſting of ſix places, but as Periods of this kind ſeldom or never occur in buſineſs, it is ſufficient only to mention them in this place, without ſaying any thing further about them.

TABLE I.

| Third Period. | | | Second Period. | | | First Period. | | |
|---|---|---|---|---|---|---|---|---|
| C Millions | X Millions | Millions | C Thouſands | X Thouſands | Thouſands | Hundreds | Tens | Units |
| | | | | | | | | 9 |
| | | | | | | | 8 | 9 |
| | | | | | | 7 | 8 | 9 |
| | | | | | 9 | 7 | 8 | 9 |
| | | | | 8 | 9 | 7 | 8 | 9 |
| | | | 7 | 8 | 9 | 7 | 8 | 9 |
| | | 9 | 7 | 8 | 9 | 7 | 8 | 9 |
| | 8 | 9 | 7 | 8 | 9 | 7 | 8 | 9 |
| 7 | 8 | 9 | 7 | 8 | 9 | 7 | 8 | 9 |

TABLE II.

| Third Period. | | | Second Period. | | | Firſt Period. | | |
|---|---|---|---|---|---|---|---|---|
| C Millions | X Millions | Millions | C Thouſands | X Thouſands | Thouſands | Hundreds | Tens | Units |
| | | | | | | | | 4 |
| | | | | | | | 7 | 3 |
| | | | | | | 9 | 6 | 5 |
| | | | | | 3 | 4 | 7 | 2 |
| | | | | 4 | 8 | 9 | 1 | 3 |
| | | | 7 | 3 | 1 | 2 | 3 | 6 |
| | | 3 | 1 | 2 | 7 | 1 | 4 | 8 |
| | 4 | 3 | 1 | 9 | 2 | 7 | 6 | 4 |
| 5 | 7 | 3 | 1 | 2 | 9 | 8 | 4 | 2 |

Note, See the Notation of numbers by Latin Letters in the New Guide to the Engliſh Tongue, p. 88.

### EXAMPLES *for practice.*

*Write down in proper figures the following numbers,* viz.

Twenty nine.

Three hundred and forty eight.

Seven thouſand, two hundred and twenty-ſix.

One thouſand, three hundred and ninety.

Nineteen thouſand, ſeven hundred and twenty-eight.

Four hundred and twenty-ſeven thouſand, three hundred and ninety-ſix.

Nine hundred and forty-two thouſand, ſeven hundred.

Four million, ſeven hundred and eighty-nine thouſand, three hundred and twenty eight.

Seven million, nine hundred and forty-two thouſand, four hundred and ſeventy-five.

Twenty-ſix million, three hundred and fourteen thouſand, one hundred and ninety-five.

One hundred and ninety-ſeven million, four hundred and thirty-ſix thouſand, one hundred and ninety one.

Seven hundred and fourteen million, one hundred and nineteen thouſand, ſeven hundred and four

*Write down in words at length the following numbers,* viz.

7 —— 29 —— 846 —— 7428 —— 61261 —— 370141 —— 7126172 —— 74680218 —— 461272615.

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## OF ADDITION.

Q. WHAT is the uſe of Addition?

A. Addition teacheth to bring ſeveral particular numbers into one total ſum.

Q. How many ſorts of Addition are there?

A. Two, *viz.* Simple and Compound.

## OF SIMPLE ADDITION.

Q. What is ſimple Addition?

A. Simple or ſingle Addition, is the adding of ſeveral numbers together, whoſe ſignification is the ſame; as 6 yards and 8 yards make 14 yards.

Q. If ſeveral numbers are given to be added into one ſum, how are they to be placed?

A. They muſt be placed in ſuch manner, that Units may ſtand under Units, Tens under Tens, &c. Pounds under Pounds, Shillings under Shillings, &c.

Q. How do you prove Addition?

A. The beſt way of proving Addition is to begin at the top of the ſum, and reckon the figures downwards in the ſame manner that they were added upward: and if the ſecond line, or ſum total be equal to the firſt, it is right.

Examples *for practice.*

| *£.* | *Yds.* | *Gals.* | *Tons.* | *Hhds.* | *lb.* |
|---|---|---|---|---|---|
| 4 | 43 | 764 | 3746 | 47476 | 461713 |
| 7 | 17 | 147 | 7416 | 73712 | 761710 |
| 3 | 19 | 387 | 3406 | 31819 | 476312 |
| 2 | 13 | 736 | 7198 | 41243 | 126712 |
| 1 | 37 | 197 | 3173 | 71208 | 310748 |
| 7 | 46 | 473 | 4731 | 70956 | 471381 |
| 6 | 23 | 382 | 1264 | 84161 | 704714 |
| 4 | 59 | 769 | 4731 | 31269 | 312624 |
| 7 | 94 | 367 | 7179 | 74596 | 781462 |

| *Miles.* | *Leagues.* | *Years.* |
|---|---|---|
| 4734736 | 46431734 | 347312484 |
| 3474312 | 72261374 | 168126212 |
| 4161321 | 12612714 | 718126191 |
| 7369138 | 31371261 | 731618191 |
| 3143618 | 74147312 | 312134716 |
| 4732216 | 47312641 | 171217198 |
| 4713147 | 84167571 | 312614712 |
| 3712612 | 31216126 | 171614712 |
| 7126981 | 31187412 | 312814795 |

## OF COMPOUND ADDITION.

Q. What is Compound Addition?

A. Compound Addition is the adding of ſeveral numbers together, having divers denominations.

### 1. OF MONEY.

Q. Which are the denominations of Engliſh Money?

A.
4 Farthings make 1 Penny.
12 Pence —— 1 Shilling.
20 Shillings —— 1 Pound ſterling.

Q. Are there no other names of Money uſed in England?
A. Yes; ſuch as,

| | | £. | s. | d. |
|---|---|---|---|---|
| A Moidore | = | 1 | 7 | 0 |
| A Guinea | = | 1 | 1 | 0 |
| A Half Guinea | = | 0 | 10 | 6 |
| A Crown | = | 0 | 5 | 0 |
| A Half-Crown | = | 0 | 2 | 6 |

⁂ There are alſo ſeveral ſmaller pieces which ſpeak their own values, as a Sixpence, Fourpence, Threepence, Twopence, Penny, Halfpenny, and Farthing.

Note, the following pieces were formerly current, but now not ſo, being only imaginary.

| | | £. | s. | d. |
|---|---|---|---|---|
| A Jacobus | = | 1 | 5 | 0 |
| A Carolus | = | 1 | 3 | 0 |
| A Mark | = | 0 | 13 | 4 |
| An Angel | = | 0 | 10 | 0 |
| A Noble | = | 0 | 6 | 8 |

The Pound ſterling is alſo an imaginary ſum.

Q. Are there not ſome tables that may be learned by heart?
A. Yes; theſe following called Pence Tables.

| d. | | s. | d. | s. | | d. |
|---|---|---|---|---|---|---|
| 20 | = | 1 | 8 | 2 | = | 24 |
| 30 | = | 2 | 6 | 3 | = | 36 |
| 40 | = | 3 | 4 | 4 | = | 48 |
| 50 | = | 4 | 2 | 5 | = | 60 |
| 60 | = | 5 | 0 | 6 | = | 72 |
| 70 | = | 5 | 10 | 7 | = | 84 |
| 80 | = | 6 | 8 | 8 | = | 96 |
| 90 | = | 7 | 6 | 9 | = | 108 |
| 100 | = | 8 | 4 | 10 | = | 120 |
| 110 | = | 9 | 2 | 11 | = | 132 |
| 120 | = | 10 | 0 | 12 | = | 144 |

Note 1. Though I ſay theſe tables may be learnt by heart, I do not ſay they muſt, for then, by the ſame rule, it would be neceſſary to have tables to every rule in Addition, which nobody uſes, and not every one the Pence Tables; becauſe when they are learnt ever ſo perfectly, their uſe extends no farther than money; and therefore, they may very well be omitted, and a better method ſubſtituted in their room; I mean that of pointing, which I am ſure is both eaſier and ſafer, to beginners eſpecially. However, I choſe to ſet them down in their place, that they who approve of them may uſe them; and thoſe who do not can eaſily omit them.

2. As all the parts of Addition are built upon the ſame reaſon, ſo the method of pointing may ſerve as a general rule, when any denomination is to be added; and this may be done without defacing the figures.

## EXAMPLES.

| £ | s. | d. |
|---|---|---|
| 4 | 3 | 6 |
| 1 | 7 | 8¼ |
| 2 | 7 | 4 |
| 1 | 9 | 4½ |
| 3 | 1 | 3¼ |
| 1 | 2 | 1 |
| 4 | 7 | 6½ |
| 3 | 1 | 9 |

| £. | s. | d. |
|---|---|---|
| 1 | 1 | 3 |
| 3 | 8 | 1¼ |
| 1 | 1 | 6 |
| 3 | 4 | 7½ |
| 1 | 2 | 6 |
| 3 | 2 | 8½ |
| 7 | 4 | 6 |
| 4 | 1 | 7¾ |

| £. | s. | d. |
|---|---|---|
| 4 | 1 | 6½ |
| 1 | 2 | 7 |
| 3 | 1 | 4½ |
| 3 | 3 | 6 |
| 1 | 4 | 1½ |
| 3 | 1 | 2 |
| 1 | 5 | 8½ |
| 3 | 1 | 2 |

| £. | s. | d. |
|---|---|---|
| 14 | 12 | 1¾ |
| 17 | 11 | 2½ |
| 19 | 12 | 1½ |
| 16 | 13 | 1 |
| 12 | 13 | 6¼ |
| 14 | 12 | 7½ |
| 19 | 13 | 4 |
| 12 | 11 | 6 |

| £. | s. | d. |
|---|---|---|
| 19 | 13 | 4 |
| 12 | 11 | 6 |
| 17 | 14 | 1 |
| 19 | 13 | 4 |
| 12 | 11 | 6 |
| 19 | 13 | 1 |
| 16 | 12 | 1 |
| 19 | 11 | 4 |

| £. | s. | d. |
|---|---|---|
| 47 | 12 | 11 |
| 17 | 10 | 11 |
| 17 | 10 | 4½ |
| 32 | 12 | 6 |
| 11 | 19 | 4 |
| 12 | 12 | 6¾ |
| 11 | 13 | 1 |
| 11 | 11 | 2¼ |

| £. | s. | d. |
|---|---|---|
| 21 | 12 | 10½ |
| 31 | 11 | 11½ |
| 47 | 12 | 10¼ |
| 19 | 11 | 4 |
| 31 | 12 | 6½ |
| 12 | 11 | 4¾ |
| 37 | 11 | 4 |
| 19 | 11 | 3 |

| £. | s. | d. |
|---|---|---|
| 12 | 13 | 10 |
| 71 | 16 | 8 |
| 19 | 4 | 6¼ |
| 12 | 3 | 1 |
| 26 | 1 | 6 |
| 31 | 11 | 1 |
| 14 | 12 | 6¾ |
| 18 | 18 | 7 |

| £. | s. | d. |
|---|---|---|
| 44 | 12 | 6¼ |
| 31 | 18 | 1½ |
| 47 | 12 | 4 |
| 14 | 12 | 10¾ |
| 16 | 14 | 11 |
| 19 | 12 | 2 |
| 16 | 11 | 3 |
| 17 | 11 | 1¼ |

| £. | s. | d. |
|---|---|---|
| 21 | 11 | 11½ |
| 16 | 12 | 6 |
| 11 | 9 | 10½ |
| 16 | 12 | 4¼ |
| 34 | 1 | 10 |
| 17 | 14 | 11¼ |
| 72 | 3 | 8¾ |
| 14 | 1 | 4 |

| £. | s. | d. |
|---|---|---|
| 47 | 12 | 6½ |
| 31 | 17 | 3 |
| 17 | 13 | 11¾ |
| 18 | 14 | 10½ |
| 16 | 15 | 11 |
| 19 | 14 | 4½ |
| 77 | 18 | 6 |
| 72 | 18 | 6 |

| £. | s. | d. |
|---|---|---|
| 47 | 11 | 3¼ |
| 31 | 17 | 3 |
| 17 | 13 | 10¼ |
| 17 | 13 | 10¾ |
| 16 | 15 | 10½ |
| 17 | 15 | 11 |
| 11 | 18 | 6 |
| 17 | 17 | 3 |

## A MERCER's BILL.

Bought of *George Bailey*, May 17, 1800.

| | | *s.* | *d.* | | £. | *s.* | *d.* |
|---|---|---|---|---|---|---|---|
| 9 Yards of ſilk — | at | 14 | 6 | *per* yd. | 6 | 10 | 6 |
| 12 Yards of flowered ſilk | at | 16 | 8 | — | 10 | 0 | 0 |
| 16 Yards of ſarſenet — | at | 6 | 9 | — | 5 | 8 | 0 |
| 10 Yards of ſatin — | at | 9 | 6 | — | 4 | 15 | 0 |
| 15 Yards of brocade — | at | 10 | 8 | — | 8 | 0 | 0 |
| 11 Scarves — | at | 2 | 0 | each | 1 | 2 | 0 |
| 14 Yards of Genoa velvet | at | 17 | 4 | *per* yd. | 12 | 2 | 8 |
| 10 Yards of luſtring — | at | 5 | 2 | — | 2 | 11 | 8 |
| | | | | *Sum* | | | |

## A WOOLLEN DRAPER's BILL.

Bought of *Thomas Simmons*, June 19, 1800.

| | | *s.* | *d.* | | £. | *s.* | *d.* |
|---|---|---|---|---|---|---|---|
| 16 Yards of Drugget — | at | 7 | 0 | *per* yd. | 5 | 12 | 0 |
| 12 Yards of Broad cloth — | at | 15 | 0 | — | 9 | 0 | 0 |
| 9 Yards of black cloth — | at | 16 | 5 | — | 7 | 7 | 9 |
| 10 Yards of Shalloon — | at | 1 | 8 | — | 0 | 16 | 8 |
| 15 Yards of ſerge — | at | 1 | 10 | — | 1 | 7 | 6 |
| 7 Yards of fine Spaniſh black | at | 18 | 0 | — | 6 | 6 | 0 |
| 16 Yards of frieze — | at | 4 | 6 | — | 3 | 12 | 0 |
| 12 Yards of ſuperfine ſcarlet | at | 18 | 0 | — | 10 | 16 | 0 |
| | | | | *Sum* | | | |

## A LINEN DRAPER's BILL.

Bought of *John Clay*, July 17, 1800.

| | | *s.* | *d.* | | £. | *s.* | *d.* |
|---|---|---|---|---|---|---|---|
| 26 Ells of dowlas - - - - - - - - - - - | at | 1 | 4 | *per* ell | 1 | 14 | 8 |
| 18 Ells of Holland - - - - - - - - - - | at | 4 | 0 | — | 3 | 12 | 0 |
| 12 Ells of Diaper - - - - - - - - - - - | at | 1 | 0 | — | 0 | 12 | 0 |
| 12 Damaſk napkins - - - - - - - - - | at | 2 | 0 | each | 1 | 4 | 0 |
| 20 Yards of printed linen - - - - - | at | 2 | 0 | *per* yd. | 2 | 0 | 0 |
| 10 Yards of Cambric - - - - - - - - | at | 12 | 0 | — | 6 | 0 | 0 |
| 10 Yards of Muſlin - - - - - - - - - | at | 7 | 0 | — | 3 | 10 | 0 |
| 14 Yards of canvas - - - - - - - - - | at | 3 | 4 | — | 2 | 6 | 8 |
| | | | | *Sum* | | | |

## A GROCER's BILL.

Bought of *Thomas Hartley*, May 29, 1800.

| | | s. | d. | | £. | s. | d. |
|---|---|---|---|---|---|---|---|
| 8 lb. of raiſins of the ſun - | at | 0 | 5 | *per* lb. | 0 | 3 | 4 |
| 15 lb. of Malaga raiſins - | at | 0 | 4½ | —— | 0 | 5 | 7½ |
| 10 lb. of currants - - | at | 0 | 6½ | —— | 0 | 5 | 5 |
| 11 lb. of ſugar - - - | at | 0 | 4½ | —— | 0 | 4 | 1½ |
| 2 Sugar loaves, wt. 15 lb. | at | 0 | 9 | —— | 0 | 11 | 3 |
| 13 lb of Rice - - | at | 0 | 3 | —— | 0 | 3 | 3 |
| 5 lb. of black pepper - - | at | 1 | 6 | —— | 0 | 7 | 6 |
| 10 oz. of cloves - - | at | 0 | 10 | *per* oz. | 0 | 8 | 4 |
| | | | | *Sum* | | | |

## A CHEESE-MONGER's BILL.

Bought of *Daniel Bridge*, July 27, 1800.

| | | | s. | d. | | £. | s. | d. |
|---|---|---|---|---|---|---|---|---|
| 3 Glouceſterſhire cheeſes, | wt. 24 lb. | at | 0 | 4 | *per* lb. | 0 | 8 | 0 |
| 3 Warwickſhire —— | wt. 20 lb. | at | 0 | 3 | —— | 0 | 5 | 0 |
| 1 Cheſhire —— | wt. 28 lb. | at | 0 | 4 | —— | 0 | 9 | 4 |
| ½ Firkin of butter | wt. 28 lb. | at | 0 | 6 | —— | 0 | 14 | 0 |
| 1 Flitch of bacon | wt. 6ſt. | at | 4 | 0 | *per* ſt. | 1 | 4 | 0 |
| 7 lb. of Cambridge butter | | at | 0 | 6 | *per* lb. | 0 | 3 | 6 |
| 9 lb. of new cheeſe | | at | 0 | 4 | —— | 0 | 3 | 0 |
| 7 lb. of cream cheeſe | | at | 0 | 6 | —— | 0 | 3 | 6 |
| | | | | | *Sum* | | | |

## A MILLINER's BILL.

Bought of *Jean Innan*, Auguſt 22, 1800.

| | | s. | d. | | £. | s. | d. |
|---|---|---|---|---|---|---|---|
| 15 Yards of ſilver riband | at | 2 | 3 | *per* yd. | 1 | 13 | 9 |
| 3 Pair of fine kid gloves | at | 2 | 0 | *per* pair | 0 | 6 | 0 |
| 6 Dozen of Iriſh lamb ditto | at | 1 | 0 | —— | 3 | 12 | 0 |
| 6 Sarſenet hoods | at | 4 | 6 | each | 1 | 7 | 0 |
| 15 Fans, Indian mounts | at | 4 | 0 | —— | 3 | 0 | 0 |
| 3 Setts of knotts | at | 2 | 0 | *per* ſet | 0 | 6 | 0 |
| 16 Yards of fine lace | at | 10 | 0 | *per* yd. | 8 | 0 | 0 |
| 20 Pieces of bobbin | at | 0 | 6 | *per* piece | 0 | 10 | 0 |
| | | | | *Sum* | | | |

## A CARPENTER's BILL.

Mr. *John Law*, Dr. to *John Brooks*, for Carpenter's Work and Materials, viz.

| 1800 | | s. | d. | | £. | s. | d. |
|---|---|---|---|---|---|---|---|
| *May* 3 | For 30 feet of fir timber, at | 0 | 3 | *per* foot | 0 | 7 | 6 |
| 5 | —— 18 whole deals - - - at | 1 | 6 | each | 1 | 7 | 0 |
| | —— 16 ſlit deals - - - - - at | 1 | 0 | ——— | 0 | 16 | 0 |
| | —— 4 Hundred of ſixpenny nails - - - - | | | | 0 | 2 | 0 |
| | —— 3 Hundred of tenpenny nails - - - - | | | | 0 | 2 | 6 |
| | —— 6 Hundred of brads - - - - - - - - - - | | | | 0 | 1 | 6 |
| 21 | —— 18 Days work - - - at | 3 | 0 | *per* day | 2 | 14 | 0 |
| | | | | *Sum* | | | |

## A BAKER's BILL.

Mr. *Thomas Marriott*, Dr. to *James Barnet*.

| 1800. | | £. | s. | d. |
|---|---|---|---|---|
| *Feb.* 4 | For a peck of bran - - - | 0 | 0 | 3 |
| | —— a fine peck loaf - - - | 0 | 1 | 8 |
| 13 | —— a peck of fine flour - - - | 0 | 1 | 8 |
| 17 | —— a buſhel of pollard - - | 0 | 1 | 0 |
| 18 | —— Small bread - - - - - | 0 | 0 | 2½ |
| | —— Yeſt - - - - - - | 0 | 0 | 1 |
| | —— a half peck ſecond loaf - | 0 | 0 | 9 |
| 20 | —— a quartern ſecond loaf - - | 0 | 0 | 4½ |
| | *Sum* | | | |

## A BILL OF DISBURSEMENT.

| 1800. | | £. | s. | d. |
|---|---|---|---|---|
| *Feb.* 17 | Laid out in lamb, ſeven groats - | | | |
| 18 | —— in ſalad, five farthings - | | | |
| 21 | —— in beef ninepence halfpenny | | | |
| *Mar.* 7 | —— in parſnips, three halfpence | | | |
| 8 | —— in potatoes, a groat - | | | |
| 9 | —— in candles, ſeven groats and three pence | | | |
| 10 | —— in butter and cheeſe, eight and twenty pence - | | | |
| 12 | —— in bread, three and twenty pence. | | | |
| | *Sum* | | | |

| Suppoſe I am indebted | £. | *s.* | *d.* |
|---|---|---|---|
| To *A*, Twenty pounds, ſeven ſhillings, and four pence farthing - - - - | | | |
| — *B*, Nineteen pounds, thirteen ſhillings and tenpence halfpenny | | | |
| — *C*, Twelve pounds, fourteen ſhillings, and ſevenpence three farthings | | | |
| — *D*, Twenty ſix pounds, ſeventeen ſhillings, and fourpence farthing | | | |
| — *E*, Twenty-eight pounds, thirteen ſhillings, and ſevenpence three farthings | | | |
| — *F*, Twenty-one pounds, fifteen ſhillings, and fivepence halfpenny - - - - | | | |
| — *G*, Five pounds, ſix ſhillings, and ſevenpence farthing - - - - - - | | | |
| How much is the debt? *Sum* | | | |

## 2. OF TROY WEIGHT.

Q. Which are the denominations of Troy Weight?

A. 24 Grains, or *gr.* make 1 Pennyweight, *dwt.*
20 Pennyweights —— 1 Ounce, *oz.*
12 Ounces —— 1 Pound, *lb.*

Q. What ſort of things are weighed by this Weight?

A. Gold, Silver, Jewels, Electuaries, and all Liquors.

Q. What is the ſtandard for Gold?

A. 22 Carats of fine Gold, and 2 carats of Copper being melted together, are eſteemed the true ſtandard for Gold Coin.

Q. What is a Carat?

A. A Carat is not any certain quantity or weight but the twenty fourth part of any quantity or weight.

Q. What is the ſtandard for ſilver?

A. 11 *oz.* 2 *dwts.* of fine ſilver, and 18 *dwts.* of copper being melted together, are eſteemed the true ſtandard for ſilver coin; called ſilver ſterling.

Note, The Ounce of Silver being valued at 5 ſhillings, one Pennyweight will be valued at three pence, and the grain at half a farthing.

### EXAMPLES.

| *Oz.* | *dw.* | *gr.* | *Oz.* | *dw.* | *gr.* | *lb.* | *oz.* | *dw.* | *gr.* | *lb.* | *oz.* | *dw.* | *gr.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 10 | 12 | 7 | 13 | 12 | 4 | 10 | 12 | 11 | 7 | 10 | 12 | 10 |
| 6 | 11 | 11 | 6 | 11 | 14 | 3 | 11 | 16 | 12 | 3 | 4 | 16 | 13 |
| 5 | 16 | 11 | 9 | 12 | 17 | 1 | 4 | 16 | 19 | 3 | 7 | 12 | 11 |
| 4 | 17 | 10 | 4 | 16 | 13 | 3 | 3 | 11 | 17 | 1 | 1 | 18 | 16 |
| 1 | 12 | 16 | 7 | 11 | 14 | 4 | 1 | 16 | 14 | 3 | 11 | 16 | 12 |
| 7 | 12 | 18 | 9 | 16 | 12 | 3 | 3 | 16 | 11 | 4 | 3 | 16 | 21 |
| 9 | 16 | 19 | 7 | 13 | 16 | 7 | 11 | 16 | 10 | 3 | 3 | 13 | 11 |
| 8 | 14 | 16 | 3 | 19 | 14 | 6 | 4 | 13 | 15 | 3 | 7 | 18 | 19 |
| 4 | 16 | 10 | 5 | 9 | 8 | 5 | 11 | 14 | 13 | 9 | 8 | 19 | 9 |
| 9 | 4 | 8 | 6 | 12 | 13 | 9 | 10 | 15 | 14 | 9 | 11 | 12 | 8 |

## 3. OF AVOIRDUPOIS WEIGHT.

Q. Which are the denominations of Avoirdupois Weight?

A. 16 drams, or *dr.* make 1 Ounce, *oz.*
16 Ounces —— 1 Pound, *lb.*
28 Pounds —— 1 Quarter of an hundred weight, *qr.*
4 Quarters —— 1 Hundred weight, or 112 pounds, *cwt.*
20 Hundred wt. —— 1 Ton, *T.*

Q. What is the uſe of Avoirdupois Weight?

A Avoirdupois Weight is uſed in weighing any thing of a coarſe and droſſy nature, as all grocery and Chandlers' wares, and all metals, but ſilver and gold.

Note, Bread formerly was weighed by Troy Weight, but is now at London weighed by this weight.

Q. What is the difference between a Pound Avoirdupois and a Pound Troy?

A. The Pound Avoirdupois is equal to 14 *oz.* 11 *dwt.* 15. *gr.* and an half Troy; and the Pound Troy is equal to 13 *oz.* 2 *dr.* and an half, and $\frac{9322}{13999}$ Avoirdupois.

Q. What other denominations are there in this weight?

A. There are ſeveral other denominations in Avoirdupois Weight, in ſome particular goods, and others only cuſtomary in ſome particular places; as appears by the following table.

## TABLE.

| | lb. | | lb. |
|---|---|---|---|
| A firkin of butter is - | 56 | A burden of gad ſteel, or 9 ſcore - | 180 |
| —— of ſoap is - | 64 | A quintal of fiſh in Newfoundland | 100 |
| A barrel of pot-aſh is | 200 | A ſtone of glaſs is - | 5 |
| —— of anchovies is | 30 | A ſeam of glaſs is 24 ſtone, or — | 120 |
| —— of candles is | 120 | *For cheeſe and butter.* | |
| —— figs from - - to 2 *C.* 3 *qrs.* | 98 | A clove or half ſtone is | 8 |
| —— ſoap is - | 256 | A wey in Suffolk is 32 cloves, or — | 256 |
| —— butter is - - | 224 | —— Eſſex is 42 cloves or | 336 |
| —— gunpowder is | 112 | *For Wool.* | |
| —— raiſins is - | 112 | A clove is —— | 7 |
| A double barrel of anchovies is | 60 | A ſtone is —— | 14 |
| A puncheon of prunes is 10 *C.* or 12 *C.* | | A tod is —— | 28 |
| A fother of lead is 19 *C.* 2 *qrs.* | | A wey is 6 tod and 1 ſtone or - | 182 |
| A ſtone of iron or ſhot is | 14 | A ſack is two weys, or | 364 |
| —— of butchers' meat is | 8 | A laſt is 12 ſacks, or | 4368 |
| A gallon of train oil is | 7½ | | |
| A faggot of ſteel is | 120 | | |

### EXAMPLES.

| *T.* | *C.* | *qr.* | *lb.* | *C.* | *qr.* | *lb.* | *lb.* | *oz.* | *dr.* | *lb.* | *oz.* | *dr.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 11 | 1 | 19 | 17 | 1 | 12 | 14 | 10 | 12 | 12 | 10 | 12 |
| 1 | 12 | 3 | 11 | 17 | 2 | 11 | 16 | 12 | 11 | 17 | 12 | 10 |
| 3 | 4 | 1 | 17 | 14 | 1 | 12 | 19 | 12 | 12 | 14 | 12 | 13 |
| 3 | 1 | 2 | 13 | 16 | 3 | 19 | 17 | 12 | 14 | 16 | 12 | 11 |
| 7 | 11 | 1 | 11 | 19 | 1 | 12 | 14 | 13 | 10 | 20 | 12 | 13 |
| 6 | 3 | 2 | 13 | 16 | 3 | 18 | 16 | 15 | 14 | 20 | 13 | 4 |
| 3 | 2 | 2 | 20 | 12 | 2 | 22 | 23 | 14 | 13 | 24 | 14 | 3 |
| 4 | 5 | 3 | 26 | 19 | 3 | 17 | 27 | 12 | 10 | 22 | 10 | 7 |

## 4. OF APOTHECARIES' WEIGHT.

Q. Which are the denominations of Apothecaries' Weight?

A.

| | | | |
|---|---|---|---|
| 20 Grains, or *gr.* | make | 1 Scruple, | ℈. |
| 3 Scruples | —— | 1 Dram, | ʒ. |
| 8 Drams | —— | 1 Ounce, | ℥. |
| 12 Ounces | —— | 1 Pound, | ℔ |

Q What is the uſe of Apothecaries' Weight?

A. Apothecaries' Weight is ſuch as their medicines are compounded by.

Note 1. The Apothecaries mix their medicines by this rule, yet buy and ſell their commodities by Avoirdupois Weight.

2. The Apothecaries' pound and ounce, and the pound and ounce Troy, are the ſame, only differently divided and ſubdivided.

| ℔ | ℥ | ʒ | ℈ | *gr.* | ℔ | ℥ | ʒ | ℈ | *gr.* | ℔ | ℥ | ʒ | ℈ | *gr.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 11 | 7 | 2 | 19 | 7 | 1 | 3 | 1 | 10 | 7 | 3 | 2 | 2 | 11 |
| 1 | 3 | 4 | 1 | 13 | 0 | 1 | 2 | 1 | 14 | 6 | 2 | 7 | 0 | 12 |
| 0 | 1 | 7 | 2 | 12 | 7 | 3 | 4 | 1 | 12 | 3 | 7 | 2 | 2 | 8 |
| 2 | 2 | 6 | 2 | 8 | 6 | 2 | 2 | 2 | 8 | 2 | 3 | 2 | 0 | 9 |
| 2 | 3 | 4 | 2 | 9 | 0 | 0 | 3 | 2 | 17 | 2 | 2 | 3 | 2 | 8 |
| 3 | 2 | 3 | 0 | 12 | 0 | 0 | 3 | 2 | 7 | 3 | 4 | 1 | 1 | 12 |
| 7 | 10 | 3 | 2 | 9 | 0 | 0 | 3 | 0 | 8 | 0 | 3 | 4 | 2 | 7 |
| 2 | 7 | 6 | 2 | 8 | 0 | 3 | 7 | 2 | 6 | 7 | 3 | 2 | 2 | 13 |

## 5 OF LONG MEASURE.

Q. Which are the denominations of Long Meaſure?

A. 3 Barley-Corns, or *b. c.* make 1 Inch, *in.*
4 Inches —— ——— 1 Hand, *hd.*
12 Inches —— ——— 1 Foot, *ft.*
3 Feet —— ——— 1 Yard, *yd.*
6 Feet —— ——— 1 Fathom, *fa.*
5 Yards and a half—— 1 Rod, Pole or Perch, *po.*
40 Poles - - - 1 Furlong, *fu.*
8 Furlongs - - - 1 Mile, *m.*
3 Miles - - - 1 League, *l.*
60 Miles - - - 1 Degree, *deg.*

Note. A degree is 69 miles and 4 furlongs, very near, though commonly reckoned but 60 Miles.

Q. What is the uſe of Long Meaſure?

A. To meaſure diſtances of places, or any thing elſe where length is conſidered, without regard to the breadth.

Q. Is the Pole or Perch always of the ſame length?

A. No. Q. What is the difference?

A. Five yards and a half are the ſtatute meaſure for a pole or perch; but for fens and woodlands, it is cuſtomary to reckon 18 feet to the pole; and for foreſts 21 feet.

Q. What is the uſe of a Hand ?
*A.* It is uſed to meaſure horſes.
Q. What is the uſe of a Fathom ?
*A.* It is uſed to meaſure depths.

EXAMPLES.

| *M.* | *fu.* | *p.* | *Yds.* | *f.* | *in.* | *L.* | *m.* | *fu.* | *p.* | *Yds.* | *f.* | *in.* | *b.* | *c.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 7 | 19 | 14 | 2 | 7 | 17 | 2 | 6 | 14 | 16 | 1 | 0 | 0 | |
| 16 | 1 | 14 | 16 | 1 | 4 | 12 | 1 | 2 | 18 | 14 | 2 | 10 | 1 | |
| 19 | 3 | 16 | 19 | 1 | 10 | 16 | 2 | 1 | 16 | 17 | 2 | 4 | 2 | |
| 17 | 4 | 19 | 16 | 2 | 4 | 19 | 2 | 7 | 11 | 13 | 2 | 11 | 1 | |
| 12 | 1 | 11 | 14 | 2 | 5 | 19 | 0 | 4 | 32 | 16 | 1 | 7 | 2 | |
| 18 | 3 | 16 | 14 | 2 | 1 | 17 | 1 | 1 | 12 | 17 | 1 | 4 | 0 | |
| 19 | 7 | 14 | 11 | 1 | 3 | 12 | 2 | 1 | 17 | 9 | 2 | 6 | 2 | |
| 16 | 6 | 26 | 11 | 0 | 1 | 12 | 1 | 1 | 24 | 9 | 2 | 1 | 2 | |

## 6. OF CLOTH MEASURE.

Q. Which are the denominations of Cloth Meaſure ?

| | | |
|---|---|---|
| A. 2 Inches, or *in.* and a quarter make | 1 Nail, *n.* | |
| 4 Nails | 1 Qr. of a Yd. *qr.* | |
| 4 Quarters | 1 Yard, *yd.* | |
| 3 Quarters of a Yard | 1 Flemiſh Ell, *F.E.* | |
| 5 Quarters of a Yard | 1 Engliſh Ell, *E.* | |

*Note,* 1. The yard is uſed in meaſuring all ſorts of woollen cloths, wrought ſilks, moſt linens, tape, and gartering.

2. The ell Engliſh is uſed in meaſuring ſome particular linens called Hollands.

3. The ell Flemiſh is uſed in meaſuring tapeſtry.

EXAMPLES.

| *Yds.* | *qrs.* | *na.* | *Ells* | *qrs.* | *na.* | *Yds.* | *qrs.* | *na.* | *E.F.* | *qrs.* | *na.* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 1 | 1 | 44 | 1 | 2 | 17 | 2 | 1 | 17 | 1 | 2 |
| 11 | 3 | 1 | 17 | 3 | 1 | 16 | 3 | 3 | 17 | 1 | 3 |
| 16 | 1 | 2 | 14 | 3 | 1 | 17 | 3 | 2 | 14 | 1 | 2 |
| 29 | 3 | 1 | 16 | 3 | 2 | 19 | 2 | 0 | 19 | 2 | 0 |
| 17 | 1 | 2 | 19 | 1 | 1 | 17 | 3 | 2 | 14 | 1 | 0 |
| 11 | 3 | 3 | 19 | 2 | 3 | 16 | 2 | 3 | 19 | 2 | 0 |
| 19 | 1 | 1 | 16 | 3 | 1 | 19 | 2 | 1 | 17 | 2 | 2 |
| 14 | 2 | 3 | 15 | 1 | 2 | 17 | 1 | 2 | 16 | 1 | 3 |

## 7. OF LAND MEASURE.

Q. Which are the denominations of Land Meaſure?

A. 9 Square feet, or *ft.* make 1 Yard, *yd.*
30 Yards and a quarter —— 1 Pole, *po.*
40 Poles in length and 1 in breadth 1 Rood, *r.*
4 Roods —— —— 1 Acre, *a.*

Q. What is the uſe of Land Meaſure?

A. It gives the content of any piece of ground in acres.

EXAMPLES.

| *A.* | *r.* | *p.* | *A.* | *r.* | *p.* | *A.* | *r.* | *p.* |
|---|---|---|---|---|---|---|---|---|
| 17 | 3 | 12 | 17 | 1 | 22 | 26 | 1 | 36 |
| 12 | 2 | 15 | 24 | 2 | 3 | 13 | 2 | 23 |
| 15 | 1 | 22 | 15 | 3 | 27 | 23 | 3 | 22 |
| 26 | 2 | 12 | 19 | 1 | 23 | 36 | 2 | 13 |
| 17 | 2 | 27 | 12 | 2 | 16 | 22 | 2 | 28 |
| 13 | 2 | 23 | 16 | 3 | 24 | 29 | 0 | 33 |
| 12 | 2 | 7 | 7 | 1 | 12 | 33 | 3 | 16 |
| 25 | 3 | 22 | 12 | 3 | 14 | 27 | 2 | 24 |

## 8. OF LIQUID MEASURE.

Q. How many ſorts of Liquid Meaſure are there?

A. Two; Wine Meaſure and Wincheſter meaſure.

Q. What is meant by Wincheſter Meaſure?

A. It is a particular meaſure uſed for beer and ale.

Q. What is the difference between Wine Meaſure and Wincheſter Meaſure?

A. A gallon of Wine is 231 ſolid inches; but a gallon of beer or ale exceeds that meaſure by 51 inches, and is 282 ſolid inches.

### (1.) *Of Wine Meaſure.*

Q. Which are the denominations of Wine Meaſure?

A. 2 Pints, or *pts.* make 1 Quart, *qt.*
4 Quarts —— 1 Gallon, *gal.*
10 Gallons —— 1 Anchor of brandy or rum, *an*
18 Gallons —— 1 Runlet, *R.*
31½ Gallons —— 1 Barrel, *bar.*
42 Gallons —— 1 Tierce, *T.*
63 Gallons —— 1 Hogſhead, *hhd.*
84 Gallons —— 1 Puncheon, *pun.*
2 Hogſheads —— 1 Pipe or butt, *p.*
2 Pipes or 4 hogſheads 1 Ton, *T.*

Q. What other liquors are meaſured by the Wine Standard?

A. All Brandies, Spirits, Strong Waters, Perry, Cider, Mead, Vinegar, Honey, and Oil.

Note, Milk is alſo retailed by this ſtandard, not by law, but by cuſtom only.

### Examples.

| *T.hhds.* | *gal.* | *qts* | *Hhds.* | *gal.* | *qts.* | *Tier.* | *gal.* | *qts.* |
|---|---|---|---|---|---|---|---|---|
| 7 | 1 | 12 | 2 | 27 | 10 | 2 | 27 | 12 | 2 |
| 6 | 3 | 31 | 3 | 22 | 13 | 3 | 29 | 17 | 3 |
| 7 | 2 | 41 | 3 | 26 | 12 | 3 | 22 | 12 | 2 |
| 6 | 2 | 17 | 1 | 29 | 12 | 2 | 27 | 32 | 3 |
| 7 | 3 | 14 | 3 | 23 | 22 | 0 | 29 | 12 | 2 |
| 2 | 2 | 19 | 2 | 27 | 32 | 2 | 27 | 12 | 2 |
| 9 | 2 | 15 | 2 | 29 | 29 | 3 | 26 | 17 | 2 |
| 3 | 1 | 12 | 2 | 26 | 33 | 2 | 22 | 14 | 3 |

## (2.) *Of Wincheſter Meaſure.*

Q. Which are the denominations of Wincheſter Meaſure?

A. 2 Pints or *pts.* —— make 1 Quart, *qt.*
4 Quarts ------- —— 1 Gallon, *gal.*
8 Gallons ------- —— 1 Firkin of ale, *fir.*
9 Gallons ------- —— 1 Firkin of beer, *fir.*
2 Firkins -------- —— 1 Kilderkin, *kil.*
4 Firkins -------- —— 1 Barrel, *bar.*
1 Barrel and a half, or 54 gallons 1 Hogſhead of beer, *hhd.*

Q. What is the difference between ale and beer Meaſure?

A. In London only they compute 8 gallons to the firkin of ale, and 32 gallons to the barrel; but in all other parts of England, for ale, ſtrong beer, and ſmall beer, 34 gallons are computed to the barrel, and 8 gallons and an half to the firkin.

Q. What other commodities are there that go by the Wincheſter Meaſure?

A. A Barrel of ſalmon or eels is 42 Gallons.
A Barrel of herrings — 32 Gallons.
A Keg of ſturgeon — 4 or 5 Gallons.
A Firkin of ſoap — 8 Gallons.

EXAMPLES.

| *Hhds.* | *gal.* | *qts.* | *B B.* | *fir.* | *gal.* | *Hhds.* | *gals.* | *qts.* | *A.B.* | *fir.* | *gal.* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 12 | 1 | 23 | 3 | 3 | 26 | 17 | 1 | 23 | 1 | 7 |
| 6 | 27 | 2 | 27 | 2 | 6 | 13 | 19 | 2 | 24 | 2 | 6 |
| 3 | 21 | 2 | 20 | 3 | 7 | 21 | 16 | 3 | 27 | 1 | 5 |
| 2 | 22 | 1 | 27 | 2 | 8 | 32 | 18 | 2 | 27 | 3 | 4 |
| 3 | 17 | 2 | 26 | 0 | 5 | 27 | 10 | 1 | 26 | 3 | 2 |
| 2 | 12 | 1 | 37 | 1 | 4 | 32 | 28 | 2 | 27 | 1 | 3 |
| 6 | 17 | 3 | 27 | 0 | 3 | 26 | 26 | 0 | 27 | 2 | 1 |
| 7 | 41 | 2 | 32 | 1 | 2 | 31 | 31 | 2 | 27 | 1 | 0 |

## 9. OF DRY MEASURE.

Q. Which are the uſual denominations of Dry Meaſure?

A. 2 Pints, or *pts.* make 1 Quart, *qt*
2 Quarts —— 1 Pottle, *pot.*
2 Pottles —— 1 Gallon, *gal.*
2 Gallons —— 1 Peck, *p.*
4 Pecks —— 1 Buſhels, *buſh.*
8 Buſhels —— 1 Quarter of Corn, *qr.*
36 Buſhels —— 1 Chaldron of coals, *ch.*

Q. Wherein does London differ from other places in England, in the Coal Meaſure?

A. In London 36 buſhels make a chaldron; but in all other places 32 buſhels make a chaldron. The buſhel alſo in Water Meaſure contains 5 pecks.

Q. What other denominations are there in Dry Meaſure?

A. A Score of Coals is 21 Chaldrons.
A Sack of Coals — 3 Buſhels.
A Sack of Corn — 4 Buſhels.
10 Quarters of Corn make 1 Wey.
12 Weys —— 1 Laſt.
A Load of Corn —— 5 Buſhels
A Cart load ditto —— 40 Buſhels.

Q. What is the uſe of Dry Meaſure?

A. Dry Meaſure is applied to all dry goods, as Corn, Seeds, Fruits, Roots, Sands, Salt, Sea-Coal, Charcoal, Small-coal, Oyſters, Muſcles, and Cockles.

Q. What is the ſtandard for Dry Meaſure?

A. The Standard for Dry Meaſure is a Wincheſter buſhel, being 18 inches and a half wide throughout, and 8 inches deep. One gallon of this quantity is 268 ſolid inches and $\frac{4}{5}$, and conſequently is leſs than an ale gallon by 13 ſolid inches and $\frac{1}{5}$.

EXAMPLES.

| *Ch.* | *bu.* | *p* | *Qrs.* | *bu.* | *p.* | *Ch.* | *bu* | *p.* | *Qrs.* | *bu.* | *p.* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 10 | 3 | 14 | 7 | 2 | 27 | 10 | 1 | 36 | 7 | 3 |
| 16 | 10 | 2 | 24 | 1 | 0 | 27 | 20 | 2 | 36 | 6 | 3 |
| 19 | 11 | 0 | 26 | 3 | 2 | 17 | 12 | 3 | 43 | 3 | 2 |
| 17 | 10 | 2 | 19 | 2 | 0 | 24 | 22 | 2 | 22 | 3 | 3 |
| 16 | 19 | 2 | 16 | 3 | 2 | 32 | 35 | 3 | 36 | 5 | 2 |
| 17 | 10 | 2 | 17 | 0 | 0 | 72 | 26 | 1 | 28 | 4 | 2 |
| 17 | 12 | 0 | 12 | 3 | 2 | 55 | 12 | 3 | 33 | 7 | 0 |
| 15 | 14 | 3 | 37 | 3 | 3 | 27 | 14 | 0 | 46 | 3 | 2 |

## 10. OF TIME.

Q. Which are the denominations of Time?

*A.* 60 Seconds or *ſec.* make 1 Minute, *min.*
60 Minutes —— 1 Hour, *hr.*
24 Hours —— 1 Day, *da.*
7 Days —— 1 Week, *wk.*
4 Weeks —— 1 Month, *mo.*
13 Months, 1 day and 6 hours 1 common or Julian year, *yr.*

Q. What is a Solar year?

*A.* According to the beſt computation, a Solar Year is 365 days, 5 hours 48 minutes, and 55 ſeconds.

Q. How is the year divided by the Calendar?

*A.* No more days than 30 hath th' month of September,
The ſame may be ſaid of June, April, November,
The reſt of the months have juſt 30 and one,
Except that ſhort month February alone,
Which to itſelf claimeth juſt 8 and a ſcore,
But in ev'ry Leap Year we give it one more.

EXAMPLES.

| *M.* | *w.* | *d.* | *H.* | *m.* | *ſec.* | *M.* | *w.* | *d.* | *D.* | *h.* | *m.* | *ſec.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 2 | 6 | 17 | 10 | 32 | 30 | 2 | 1 | 17 | 11 | 12 | 16 |
| 17 | 2 | 5 | 17 | 22 | 20 | 17 | 3 | 6 | 19 | 12 | 16 | 11 |
| 16 | 1 | 3 | 25 | 10 | 35 | 31 | 2 | 5 | 17 | 11 | 12 | 16 |
| 29 | 2 | 2 | 4 | 22 | 3 | 17 | 0 | 6 | 13 | 12 | 26 | 35 |
| 25 | 1 | 2 | 7 | 20 | 0 | 16 | 2 | 4 | 25 | 12 | 14 | 58 |
| 26 | 3 | 0 | 73 | 3 | 30 | 27 | 3 | 1 | 17 | 19 | 25 | 47 |
| 12 | 2 | 2 | 22 | 28 | 40 | 29 | 0 | 5 | 13 | 23 | 26 | 54 |

### OF MOTION..

Q. Which are the denominations of motion in the heavenly bodies?

*A.* 60 Seconds, or ″ make 1 Prime minute′,
60 Minutes ——— 1 Degree °.
30 Degrees ——— 1 Sign.
12 Signs, or 360 degrees, make the whole great circle of the Zodiac.

EXAMPLES.

| ° | ′ | ″ | ° | ′ | ″ | ° | ′ | ″ |
|---|---|---|---|---|---|---|---|---|
| 71 | 10 | 16 | 47 | 47 | 47 | 46 | 17 | 33 |
| 12 | 11 | 19 | 17 | 17 | 10 | 47 | 36 | 48 |
| 17 | 16 | 43 | 32 | 12 | 33 | 42 | 15 | 32 |
| 19 | 15 | 26 | 23 | 13 | 30 | 43 | 19 | 44 |
| 17 | 48 | 55 | 26 | 26 | 17 | 26 | 12 | 20 |
| 14 | 35 | 22 | 73 | 23 | 19 | 73 | 15 | 20 |
| 17 | 26 | 24 | 16 | 16 | 43 | 46 | 19 | 17 |
| 15 | 36 | 47 | 23 | 23 | 22 | 24 | 26 | 43 |

## 12. Of Things bought and ſold by the Tale.

Q. Which are the denominations of things accounted by the Tale?

*A.* 12 Particulars make 1 Dozen.
12 Dozen ——— 1 Groſs.
12 Groſs or 144 dozen 1 great Groſs.

EXAMPLES *are needleſs.*

### QUESTIONS to exerciſe ADDITION.

1. A man was born in the year 1800, I demand when he will be 57 years of age?

2. There are two numbers whoſe difference is 17, and the leſſer number is 44—what is the greater number? 61

3 A. man borrowed a ſum of money, and paid in part, 12*l.* 10*s.* and the remainder is 17*l.* 10*s.*—I demand the ſum borrowed?

4. *A* owes me three guineas, *B* 50*l.* 12*s.* *C* 104*l.* *D* threeſcore and ſeventeen pounds—how much is due to me in all?

5. *A*, *B*, and *C* bought a parcel of goods, in the purchaſe of which *A* laid out 3*l.* *B* 40*s.* and *C* 20*d.*— how much was laid out in all?

6. A man hath 6 bags of hops; the firſt weighs 2 *qrs.* 14 *lb.* and each of the reſt weighs 14 *lb.* more—what quantity hath he in the whole?

7. A man took an houſe for 12 years; and by agreement was to pay 100*l.* 10*s.* down; 190*l.* 4*s.* at the end of 6 years, and 109*l.* 6*s.* at the end of 12 years—I demand the whole ſum?

8. A ſhopkeeper having opened a ſhop, the firſt week ſold goods to the value of threeſcore pounds, the next week he took fourſcore pounds; but the third week he took no more than thirty ſhillings—how much did he receive in all?

---

## OF SUBTRACTION.

Q. WHAT is the uſe of Subtraction?

A. By taking a leſs number from a greater, it ſhews the difference between both.

Q. How many ſorts of Subtraction are there?

A. Two; Simple and Compound.

### *Of Simple Subtraction.*

Q. What is Simple Subtraction?

A. Simple or Single Subtraction is the finding a difference between any two numbers whoſe ſignification is the ſame; as the difference between 6 yards and 4 yards is 2 yards.

Q. How are numbers to be placed in Subtraction?

A. With units under units, tens under tens, &c. as in Addition.

Q. What rule have you for the operation of Subtraction in general.

A. When the lower number is greater than the upper, take the lower number from the number which you borrow, and to that difference add the upper number, carrying one to the next lower place.

Q. What number muſt you borrow, when the lower number is greater?

A. The ſame which you ſtop at in Addition.

Q. How do you prove Subtraction?

A. By adding the remainder and the leſſer line together, which will always be equal to the greater line. Or,

By ſubtracting the remainder from the greater line, and that difference will always be equal to the leſſer line.

### EXAMPLES.

| | *£.* | *Yards.* | *Miles.* | *Days.* | *Months.* |
|---|---|---|---|---|---|
| *From* | 762 | 7694 | 41362 | 761214 | 7713570 |
| *Take* | 122 | 1867 | 13976 | 121812 | 2813126 |
| *Diff.* | | | | | |

| | *Hours.* | *lb.* | *Crowns.* | *Months.* |
|---|---|---|---|---|
| *From* | 31261812 | 312617127 | 711161871 | 7612641 |
| *Take* | 19879428 | 163121712 | 27571014 | 5910927 |
| *Diff.* | | | | |

## *Of Compound Subtraction.*

Q. What is Compound Subtraction?

*A.* Compound Subtraction produces a difference between any ſums of divers denominations.

### OF MONEY.

### EXAMPLES.

| | *£.* | *s.* | *d.* | *£.* | *s.* | *d.* | *£.* | *s.* | *d.* | *£.* | *s.* | *d.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *From* | 13 | 10 | 6½ | 36 | 12 | 6½ | 76 | 12 | 6¾ | 31 | 18 | 4½ |
| *Take* | 3 | 17 | 8½ | 13 | 12 | 2¼ | 27 | 13 | 3¼ | 16 | 19 | 1 |
| *Diff.* | | | | | | | | | | | | |

| | *£.* | *s.* | *d.* | *£.* | *s.* | *d.* | *£.* | *s.* | *d.* | *£.* | *s.* | *d.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Borr.* | 41 | 15 | 3 | 76 | 12 | 4½ | 73 | 7 | 6 | 17 | 12 | 4½ |
| *Paid* | 19 | 17 | 1½ | 13 | 17 | 7 | 19 | 4 | 1½ | 14 | 7 | 2 |
| *Unpd.* | | | | | | | | | | | | |

| | *£.* | *s.* | *d.* | *£.* | *s.* | *d.* | *£.* | *s.* | *d.* | *£.* | *s.* | *d.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Lent* | 137 | 11 | 6½ | 47 | 17 | 6 | 413 | 11 | 7¾ | 71 | 18 | 9 |
| *Rec.* | 76 | 12 | 7¾ | 29 | 11 | 6¼ | 171 | 18 | 9½ | 17 | 16 | 10¾ |
| *Due* | | | | | | | | | | | | |

## EXAMPLES.

| | £. | s. | d. | | £. | s. | d. |
|---|---|---|---|---|---|---|---|
| *Borrowed* | 764 | 0 | 0 | *Lent* | 800 | 10 | 6 |
| *Paid at ſeveral times* | 13 | 2 | 2½ | *Received at ſeveral times* | 12 | 12 | 2½ |
| | 17 | 2 | 2 | | 29 | 10 | 6 |
| | 16 | 3 | 6¾ | | 27 | 12 | 2½ |
| | 21 | 3 | 2 | | 24 | 10 | 3 |
| | 22 | 14 | 10 | | 29 | 12 | 2 |
| | 66 | 13 | 5¼ | | 24 | 10 | 8¾ |
| | 23 | 19 | 6½ | | 27 | 16 | 2¼ |
| | 26 | 12 | 2½ | | 46 | 12 | 7¼ |
| *Paid in all* | | | | *Received in all* | | | |
| *Unpaid* | | | | *Remains due* | | | |

## 2. OF TROY WEIGHT.

| | *Oz.* | *dwt.* | *gr.* | *Oz* | *dwt.* | *gr.* | *Oz.* | *dwt.* | *gr.* | *lb.* | *oz.* | *dwt.* | *gr.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *From* | 72 | 12 | 12 | 72 | 12 | 18 | 23 | 16 | 12 | 84 | 4 | 11 | 12 |
| *Take* | 2 | 10 | 19 | 10 | 4 | 19 | 5 | 19 | 14 | 27 | 10 | 11 | 7 |
| *Diff* | | | | | | | | | | | | | |

## 3. OF AVOIRDUPOIS WEIGHT.

| | *C.* | *qrs.* | *lb.* | *lb.* | *oz.* | *dr.* | *lb.* | *oz* | *dr.* | *T.* | *C.* | *qr.* | *lb.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Bought* | 72 | 2 | 18 | 27 | 2 | 1 | 27 | 10 | 1 | 22 | 1 | 2 | 10 |
| *Sold* | 3 | 2 | 26 | 10 | 13 | 2 | 25 | 14 | 3 | 5 | 3 | 1 | 19 |
| *Unſold* | | | | | | | | | | | | | |

## OF APOTHECARIES' WEIGHT.

| | ℥ | ʒ | ℈ | *gr.* | ℥ | ʒ | ℈ | *gr.* | ℔ | ℥ | ʒ | ℈ | *gr.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *From* | 65 | 4 | 2 | 10 | 47 | 5 | 1 | 16 | 48 | 2 | 2 | 0 | 19 |
| *Take* | 7 | 6 | 2 | 12 | 2 | 2 | 2 | 18 | 10 | 1 | 2 | 2 | 17 |
| *Diff.* | | | | | | | | | | | | | |

## 5. LONG MEASURE.

| | *L.* | *m.* | *f.* | *p.* | *Yd* | *f.* | *n.* | *b.c.* | *L.* | *m.* | *fu.* | *p.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *From* | 71 | 1 | 3 | 10 | 40 | 0 | 3 | 2 | 61 | 0 | 1 | 3 |
| *Take* | 14 | 2 | 5 | 16 | 11 | 0 | 1 | 1 | 19 | 1 | 2 | 10 |
| *Diff.* | | | | | | | | | | | | |

## 6. CLOTH MEASURE.

| | *Yds.* | *qr.* | *na.* | *E.F.* | *qr.* | *na.* |
|---|---|---|---|---|---|---|
| *Bou.* | 71 | 3 | 1 | 51 | 2 | 2 |
| *Sold* | 14 | 2 | 3 | 16 | 1 | 3 |
| *Unſold* | | | | | | |

| | *Yds.* | *q.* | *na.* | *E.F.* | *qr.* | *na.* |
|---|---|---|---|---|---|---|
| *From* | 47 | 2 | 2 | 17 | 2 | 2 |
| *Take* | 12 | 1 | 3 | 14 | 4 | 3 |
| *Diff.* | | | | | | |

| | *Yds.* | *qr.* | *na.* |
|---|---|---|---|
| *A draper bought* | 148 | 0 | 0 |
| *Sold at ſeveral times.* | 14 | 1 | 2 |
| | 17 | 3 | 3 |
| | 19 | 1 | 2 |
| | 16 | 2 | 1 |
| | 17 | 3 | 3 |
| *Sold in all* | | | |
| *Unſold* | | | |

## 7. LAND MEASURE.

| | *A.* | *r.* | *p.* | *A.* | *r.* | *p.* | *A.* | *r.* | *p.* | *A.* | *r.* | *p.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Bought* | 12 | 1 | 10 | 17 | 3 | 17 | 38 | 1 | 7 | 32 | 0 | 9 |
| *Tilled* | 5 | 3 | 17 | 12 | 3 | 23 | 19 | 1 | 28 | 16 | 2 | 24 |
| *Untilled* | | | | | | | | | | | | |

## 8. WINE MEASURE.

| | *T.* | *hhds.* | *gal.* | *T.* | *hhds.* | *gal.* | *Gal.* | *qts.* | *pts.* | *Gal.* | *qts.* | *pts.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *From* | 3 | 2 | 10 | 7 | 2 | 10 | 19 | 2 | 1 | 67 | 1 | 1 |
| *Take* | 1 | 3 | 19 | 1 | 2 | 28 | 12 | 1 | 1 | 12 | 3 | 0 |
| *Diff.* | | | | | | | | | | | | |

## 9. WINCHESTER MEASURE.

|  | *Hhds.* | *gal.* | *qts.* | *A.B.* | *f.* | *gal.* | *B.B.* | *f.* | *gal.* | *Hhds.* | *gal.* | *qts.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Bou.* | 17 | 10 | 1 | 17 | 2 | 1 | 48 | 1 | 3 | 41 | 2 | 2 |
| *Sold* | 12 | 11 | 2 | 14 | 1 | 3 | 17 | 1 | 7 | 23 | 3 | 3 |

## 10. DRY MEASURE.

|  | *Ch.* | *bu.* | *p.* | *Ch.* | *bu.* | *p.* | *Qrs.* | *bu.* | *p.* | *Qrs.* | *bu.* | *p.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *From* | 17 | 2 | 1 | 40 | 1 | 2 | 19 | 1 | 1 | 26 | 1 | 3 |
| *Take* | 10 | 1 | 3 | 16 | 5 | 1 | 12 | 7 | 2 | 19 | 1 | 2 |

## 11. TIME.

|  | *D.* | *h.* | *m.* | *ſec.* | *W.* | *d.* | *h.* | *m.* | *ſec.* | *W.* | *d.* | *h.* | *m.* | *ſec.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *From* | 41 | 13 | 22 | 12 | 14 | 1 | 10 | 12 | 10 | 17 | 1 | 10 | 12 | 10 |
| *Take* | 22 | 16 | 33 | 31 | 10 | 3 | 19 | 48 | 26 | 10 | 2 | 14 | 6 | 15 |

## 12. MOTION.

|  | ° | ′ | ″ | ° | ′ | ″ |  | ′ | ″ |
|---|---|---|---|---|---|---|---|---|---|
| *From* | 48 | 10 | 12 | 47 | 2 | 10 | 62 | 13 | 9 |
| *Take* | 19 | 11 | 16 | 12 | 19 | 46 | 49 | 18 | 33 |

## QUESTIONS to exerciſe SUBTRACTION.

1. A man was born in the year 1702,—I demand his age in the year 1800?

2. There are two numbers, the greater number is 61, and the leſſer number is 44,—I demand the difference?

3. There are two numbers, whoſe difference is 17, and the greater number is 61,—I demand the leſſer number

4. The brewer and the baker drew bills each upon the other; the brewer ſtands indebted 45l. 19s. and the baker 26l. and $7\frac{1}{2}$d.—who is the proper perſon indebted, and how much?

5. A man borrowed 30*l.* and paid in part 12*l.* 10*s.*—I demand how much remains unpaid?

6. King Charles the Martyr was beheaded in the year 1648—how many years is it ſince?

7. A is indebted to the brewer the ſum of 109*l* 10*s.* *B* owes him 94*l.* 4*s.* 10½d.—how much does one owe more than the other?

8. What ſum is that which taken from 100*l.* leaves 48*l.* 17*s.* 6½d.?

9. There were 4 bags of Money, containing as follows, viz. The firſt bag 24*l.* the ſecond bag 50*l.* the third bag 100*l.* and the fourth bag 150*l.* which were to be paid to ſeveral perſons; but one of the bags being loſt, there were but 234*l.* paid—I demand which bag was wanting?

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## OF MULTIPLICATION.

Q. WHAT is Multiplication?

*A.* It is the ſhort way of performing ſeveral Additions.

Q. How many parts are there in Multiplication?

A. Three, viz.

1. The Multiplicand, or ſum to be multiplied.
2. The Multiplier, or ſum multiplied by.
3. The Product, or total of the Multiplicand, as often as there are units in the multiplier.

Note, The Multiplicand and the Multiplier are alſo called Factors, and the Product the Factor's Rectangle.

Q. How many ſorts of Multiplication are there?

A. Two, *viz.* Simple and Compound.

### *Of Simple Multiplication.*

Q. What is Simple Multiplication?

A. Simple Multiplication is the multiplying of any two numbers together, without reſpect to their ſignification; as 7 times 8 is 56.

Note, 1. As Addition and Subtraction of integers, are called Simple Addition and Simple Subtraction; ſo ſhould multiplication and Diviſion of Integers be called Simple Multiplication and Simple Diviſion; and that only ſhould be called Compound Multiplication and Compound Diviſion, which hath numbers of divers denominations to be either multiplied, or divided.

2. The following table muſt be learned perfectly by heart, before you can proceed any further.

## MULTIPLICATION TABLE.

| | | |
|---|---|---|
| 2 times | 2 is | 4 |
| | 3 | 6 |
| | 4 | 8 |
| | 5 | 10 |
| | 6 | 12 |
| | 7 | 14 |
| | 8 | 16 |
| | 9 | 18 |
| | 10 | 20 |
| | 11 | 22 |
| | 12 | 24 |
| 3 times | 3 | 9 |
| | 4 | 12 |
| | 5 | 15 |
| | 6 | 18 |
| | 7 | 21 |
| | 8 | 24 |
| | 9 | 27 |
| | 10 | 30 |
| | 11 | 33 |
| | 12 | 36 |
| 4 times | 4 | 16 |
| | 5 | 20 |
| 4 times | 6 | 24 |
| | 7 | 28 |
| | 8 | 32 |
| | 9 | 36 |
| | 10 | 40 |
| | 11 | 44 |
| | 12 | 48 |
| 5 times | 5 | 25 |
| | 6 | 30 |
| | 7 | 35 |
| | 8 | 40 |
| | 9 | 45 |
| | 10 | 50 |
| | 11 | 55 |
| | 12 | 60 |
| 6 times | 6 | 36 |
| | 7 | 42 |
| | 8 | 48 |
| | 9 | 54 |
| | 10 | 60 |
| | 11 | 66 |
| | 12 | 72 |
| 7 times | 7 | 49 |
| | 8 | 56 |
| | 9 | 63 |
| | 10 | 70 |
| | 11 | 77 |
| | 12 | 84 |
| 8 times | 8 | 64 |
| | 9 | 72 |
| | 10 | 80 |
| | 11 | 88 |
| | 12 | 96 |
| 9 times | 9 | 81 |
| | 10 | 90 |
| | 11 | 99 |
| | 12 | 108 |
| 10times | 10 | 100 |
| | 11 | 110 |
| | 12 | 120 |
| 11times | 11 | 121 |
| | 12 | 132 |
| 12times | 12 | 144 |

### CASE I.

Q What do you obſerve in the firſt caſe of multiplication?

A That the factors be placed one under another, in ſuch manner that units may ſtand under units, tens under tens, &c. and then multiply as the table directs.

### EXAMPLES.

| *£.* | *Crowns.* | *Days.* | *Hours.* |
|---|---|---|---|
| 47613127 | 47613174 | 71261812 | 71261312 |
| 2 | 3 | 4 | 5 |

| *Minutes.* | *Years.* | *Gallons.* | *Ounces.* |
|---|---|---|---|
| 73126184 | 71312674 | 31267126 | 47612312 |
| 6 | 7 | 8 | 9 |

### CASE II.

Q. What do you obſerve in the ſecond caſe of Multiplication?

A. 1. When the multiplier conſiſts of more figures than one, there muſt be made as many ſeveral products, as there are figures contained in the multiplier.

2. Let the firſt figure of every product be placed exactly under its multiplier.

3. Add theſe products together, and their ſum will be the total product.

Q. How do you prove Multiplication?

A. Multiplication and Diviſion do mutually prove each other; yet Multiplication may as truly be proved by itſelf, by inverting the factors

EXAMPLES.

| *Crowns.* | *Days.* | *Weeks.* | *Pence.* |
|---|---|---|---|
| 691861 | 129186 | 281216 | 181281 |
| 26 | 98 | 978 | 763 |
| 17988386 | 12660228 | 275029248 | 138317403 |

| *Ounces.* | *Yards.* | *Pints.* | *Quarts.* |
|---|---|---|---|
| 269181 | 261986 | 812617 | 281691 |
| 4629 | 7638 | 43859 | 76286 |
| 1246038849 | 2001049068 | 35640569003 | 21489079626 |

Q. What exceptions have you to this caſe?

A. 1. When theſe figures 1 and 1, or 1 and 2, happen together in the multiplier, you may multiply by both at once, as in CASE I.

EXAMPLES

| *Weeks.* | *Buſhels.* | *Grains.* | *Leagues* |
|---|---|---|---|
| 761312 | 671612 | 963458 | 843126 |
| 412 | 114 | 912 | 119 |
| 313660544 | 76563768 | 878673696 | 100331994 |

2. When any other number between 12 and 20 happens, as 13, 14, 15, &c. then multiply by the figures in the units Place, and as you multiply, add to the product of each ſingle figure that of the multiplicand, which ſtands next on the right hand.

### EXAMPLES.

| *Gallons.* | *Days.* | *Months.* | *lb.* |
|---|---|---|---|
| 4721217 | 4713276 | 4631261 | 4723761 |
| 15 | 16 | 17 | 18 |
| | | | |

### CASE III.

Q. What do you obſerve in the third caſe of Multiplication?

A. 1. Such Factors as have cyphers at the ends, muſt be ſet one under another, as if there were no cyphers.

2. The cyphers placed at the end of either or both of the factors, are to be omitted till the laſt product, and then the ſame number of cyphers muſt be annexed to it.

### EXAMPLES.

| *Pence.* | *Hours.* | *Years.* |
|---|---|---|
| 476000 | 180120 | 461210 |
| 170 | 48100 | 81900 |
| 80920000 | 8663772000 | 37773099000 |

| *Nails.* | *Inches.* | *Barrels.* |
|---|---|---|
| 760000 | 461200 | 618010 |
| 4800 | 72000 | 74210 |
| 3648000000 | 33206400000 | 45862522100 |

### CASE IV.

Q. What do you obſerve in the fourth caſe of multiplication?

A. When cyphers are placed between the inſignificant figures in the multiplier, they muſt be omitted in the operation: regard being had to the firſt figure of every particular product as before.

### EXAMPLES.

| *Gallons.* | *Eggs.* | *Buttons.* |
|---|---|---|
| 128121 | 128128 | 246145 |
| 72001 | 70043 | 60012 |
| 9224840121 | 8974469504 | 14771653740 |

### CASE V.

Q. How do you multiply by the parts of any number inſtead of the whole?

A. When the multiplier is ſuch a number, that any two figures being multiplied together will make the ſaid multiplier, it is ſhorter to multiply the given number by one of thoſe figures, and that product by the other, as 5 times 7 is 35.

EXAMPLES.

| *Pounds.* | *Men.* | *Soldiers.* | *Sailors.* |
|---|---|---|---|
| 764126 | 764131 | 461231 | 461312 |
| 35 | 48 | 72 | 36 |
| 26744410 | 36678288 | 33208632 | 16607232 |

## *Of Compound Multiplication.*

Q. What is Compound Multiplication?

A. When ſeveral numbers of divers denominations are given to be multiplied by one common multiplier, this is called compound multiplication.

| *£. s. d.* | *lb. oz. dw. gr.* | *C. qrs. lb.* | *lb. oz. dr.* |
|---|---|---|---|
| 17 3 1¼ | 17 5 12 16 | 43 1 14 | 17 12 10 |
| 2 | 3 | 4 | 5 |

| *M. f. p.* | *Yds. f in. b.c.* | *Yds. qrs. na.* | *B B. fir. gal.* |
|---|---|---|---|
| 16 4 21 | 17 2 3 1 | 16 3 2 | 17 2 3 |
| 6 | 7 | 8 | 9 |

| *Ch. b. p.* | *M. w. d.* | *D. h. min. ſec.* | ° ′ ″ |
|---|---|---|---|
| 16 12 3 | 16 3 4 | 17 14 14 15 | 16 11 13 |
| 10 | 11 | 12 | 7 |

Note, If the learner be taught to turn back to the bills of parcels in Addition, he will find plenty of Examples in Compound Multiplication.

### *Queſtions to exerciſe Multiplication.*

1. If one man's pay be 3s. what muſt 40 men have ?

2. What is the product of 76 multiplied by 3 and by 7 ?

3. There are 124 men employed to finiſh a piece of work, and they are to have 3l. each man ; I demand how much they muſt all have ?

4. An army of 10,000 men having plundered a city, took ſo much money, that when it was ſhared among them, each man had 27l. I demand how much money was taken in all ?

5. There were 40 men concerned in the payment of a ſum of money, and each man paid 127l. how much was paid in all ?

6. If one foot contains 12 inches, I demand how many inches there are in 126 feet ?

7. What is the product of 769 multiplied by 9 and 7 ?

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## OF DIVISION.

Q. WHAT is Diviſion ?

A. It is a ſhort way of performing ſeveral ſubtractions, and ſhews how often one number is contained in another, and what remains.

Q. How many parts are there in diviſion ?

A. Four, viz.

1. The Dividend, or ſum to be divided.
2. The Diviſor or ſum divided by.
3. The Quotient, or anſwer to the queſtion.
4. The Remainder, which is always leſs than the diviſor, and of the ſame name with the dividend.

*Note,* The diviſor, dividend, and quotient are certain : but the remainder is uncertain, becauſe ſome operations in diviſion have no remainder.

Q. How many ſorts of Diviſion are there ?

A. Two ; Simple and Compound.

### *Of Simple Diviſion.*

Q. What is Simple Diviſion ?

*A.* Simple Diviſion is when the diviſor and dividend are made choice of, without any regard to their ſignification ; as 56 divided by 7 gives 8 for the quotient ; or the number 7 is contained in 56 eight times.

Q. How many ſorts of Simple Diviſion are there ?

A. Two ; ſhort diviſion and long diviſion.

### *Of Short Diviſion.*

Q. What is Short Diviſion ?

A. Short Diviſion is, when the diviſor does not exceed 12

Examples.

| *Minutes.* | *Months.* | *Days.* |
|---|---|---|
| 2)71313674( | 6)312610041( | 11)73120013197( |
| 3)42310812( | 7)712126719( | 12)3812717314( |
| 4)13812612( | 8)701267131( | 11)1612798131( |
| 5)65231281( | 9)126713108( | 12)1731261712( |

Q. How is Diviſion proved ?

A. Multiply the diviſor and quotient together, and the remainder (if there be any) add to the product ; that ſum will be equal to the dividend.

## *Of Long Diviſion.*

### CASE I.

Q. What is Long diviſion ?

A. When the diviſor is more than 12, for the help of the memory, we are obliged to multiply the quotient figure and diviſor together, and ſubtract that product from the dividend, in order to find out the remainder ; which operation muſt be continued to every quotient figure ; and this is called Long Diviſion.

Examples.

| *Yards.* | *Shillings.* | *Pence.* |
|---|---|---|
| 91)72265871( | 28)71261714( | 1217)31917312( |
| 82)31712617( | 19)91116171( | 3164)10697826( |
| 73)17311618( | 381)13261914( | 6128)71217302( |
| 94)47312617( | 773)31746173( | 2912)17161251( |
| 55)73181061( | 937)13189714( | 33108)91261854( |
| 46)76131714( | 761)12816171) | 71126)17138716( |
| 37)31231712( | 7618)18917312( | 86257)34175362( |

### CASE II.

Q. What do you obſerve of cyphers placed at the end of the diviſor ?

A. They muſt be cut off ; and the ſame places alſo muſt be cut off in the dividend.

2. Thoſe figures which are cut off in the dividend, muſt be annexed to the remainder at laſt.

Examples.

<table>
<tr><th><i>Yards.</i></th><th><i>Crowns,</i></th></tr>
<tr><td>725|00)712613|12(</td><td>128|000)71116|071(</td></tr>
<tr><td>426|00)713126|74(</td><td>412|000)71613|181(</td></tr>
</table>

### Case III.

Q. How do you divide by the parts of any number inſtead of the whole?

A. When the diviſor is of ſuch a number that any two figures being multiplied together, will make the ſaid diviſor, it is ſhorter to divide the given numbers by one of thoſe figures, and that quotient by the other, as 5 times 7 is 35.

Examples.

| *Pence.* | *Crowns.* | *Pounds.* |
|---|---|---|
| 35)267444l0( | 48)36668288( | 72)33208652( |

## *Of Compound Diviſion.*

Q. What is Compound Diviſion?

A. When ſeveral numbers of divers denominations are given to be divided by one common diviſor; this is called Compound Diviſion.

Examples.

| | | |
|---|---|---|
| *l. s. d.* | *lb. oz. dwt. gr.* | *T. C. qr. lb.* |
| 2)48 12 6½( | 3)14 10 3 10( | 4)17 1 1 14( |
| *lb. oz. dr.* | *M. f. p.* | *Yds. f. in. b.c.* |
| 5)46 12 10( | 6)38 2 14 | 7)46 0 10 2( |
| *Yds. qrs. na.* | *A. B. fir. gal.* | *Ch. bu. p.* |
| 8)16 2 2( | 9)17 13 2( | 10)20 13 2( |
| *M. w. d.* | *D. h. m. ſec.* | ° ′ ″ |
| 11)48 2 2( | 12(46 16 12 30( | 12)33 4 11( |

## *Queſtions to exerciſe Diviſion.*

1. If 140s be divided amongſt 40 men how much apiece?

2. If 1596 be divided by 21, what is the quotient?

3. There are 124 men who have 372l. among them, how much muſt each man have?

4. An army of 10,000 men having plundered a city took 2,666,000l. how much muſt each man have?

5. There was a certain number of men concerned in the payment of 1272l and each man paid 3l. I demand the number of men?

6. What is the quotient of 48447, divided by 9 and by 7?

7. If 3264 be divided by 12 and by 4 what is the quotient.

8. A certain man intended to go a journey of about 3264 miles, would complete the ſame in 136 days, I demand how many miles he muſt travel each day?

# OF REDUCTION.

Q. WHAT is Reduction?

A. Reduction is the bringing or reducing numbers of one denomination into other numbers of another denomination, but of the ſame value.

Q. How are denominations of any kind reduced from one to another?

A. By Multiplication and Diviſion.

Q. When is Multiplication to be uſed?

A. When great names are to be brought into ſmall; as pounds into ſhillings, or days into hours, and this is called Reduction Deſcending.

Q. When is diviſion to be uſed?

A. When ſmall names are to be brought into great; as ſhillings into pounds, or hours into days, and this is called (though improperly) Reduction Aſcending.

*Note.* Whether you multiply or divide, it muſt be by as many of the leſs as make one of the greater denomination.

Q. How are queſtions in Reduction proved?

A. By varying the order of them.

## OF MONEY.

### *Of Reduction Deſcending.*

1. In 46l. how many ſhillings and pence?

*Anſ.* 920s ;. 11040*d.*

46l.
20

920s.
12

11040d.

2. In 7l. how many ſhillings and pence?

*Anſ.* 140s, ; 1680*d.*

3. In 9l, how many Shillings, pence and farthings?

*Anſ.* 180s. ; 2160*d*, 8640 *qrs.*

4. In 7l. 14s 6¼d, how many farthings?

*Anſ.* 7417. *qrs.*

5. Reduce 46l. 14s. 9¾d. into *qrs.* *Facit* 44871 *qrs.*

6. Reduce 50l. 9s. 9½d, into half-pence.

*Facit* 24235 *halfpence.*

7. Reduce 160l. 15s. 6d. into ſixpences.

*Facit* 6431 *ſixpences.*

8. Reduce 48l. 12s. 8d. into groats. *Facit* 1918 *groats.*

9. Reduce 90l. 17s. 6d. into twopences.
*Facit* 10905 *twopences.*

10. In 12 crowns how many ſhillings and pence?
*Anſ.* 60s. 720d.

11. In 15l. how many crowns and ſhillings?
*Anſ.* 60 *cr*; 300s.

12. In 50 half crowns, how many pence and farthings?
*Anſ.* 1500d, 6000 *qrs.*

13. In 306 crowns how many half crowns and pence?
*Anſ.* 612 *half-cr*; 18360d.

14 Reduce 120 ſixpences into threepences, pence, and farthings. *Facit* 240 *threepences*; 720*d.* 2880*qrs.*

15 Reduce 210 crowns, into ſhillings, groats and pence.
*Facit* 1050*s*; 3150 *groats*; 12600*d.*

16 Reduce 86 pounds into crowns, ſhillings and groats.
*Facit* 344 *cr*; 1720*s*; 5160 *groats.*

17. How many ſhillings and pence are in 17 guineas?
*Anſ.* 357*s*; 4284*d.*

18 How many crowns, and ſixpences are in 28l.
*Anſ.* 112 *crowns*; 1120 *ſixpences.*

## *Reduction Aſcending.*

1. In 11040d, how many ſhillings and pounds?
*Anſ.* 920*s.*; 46*l.*

2|0
12) 11040(92|0=46l.

2. In 1680d. how many ſhillings and pounds?
*Anſ.* 140*s.*; 7*l.*

3. In 8640 qrs. how many pence, ſhillings and pounds?
*Anſ.* 2160*d*; 180*s.* 9*l.*

4. In 7417 qrs. how many pounds? *Anſ.* £ 7 : 14 : 6¼

5. Reduce 44871 qrs. into pounds. *Facit* £ 46 : 14 : 9¾

6. Reduce 24235 halfpence into pounds.
*Facit* £ 50 : 9 : 9½

7. Reduce 6431 ſixpences into pounds. *Facit* £ 160 : 15 : 6

8. Reduce 2918 groats into pounds. *Facit* £ 48 : 12 : 8

9. Reduce 10905 twopences into pounds.
*Facit* £ 90 : 17 : 6.

10. In 720d. how many ſhillings and crowns?
*Anſ.* 60*s* : 12 *cr.*

11. In 300s. how many crowns and pounds?
*Anſ.* 60 *cr.* : 15*l.*

12. In 6000 qrs. how many pence and half-crowns?
*Anſ* 1500d.; 50 *half-crowns.*

13. In 18360d. how many half-crowns and crowns ?
*Anſ.* 612 *half-cr.* ; 306 *cr.*

14. Reduce 2880 qrs. into pence, threepences, and ſixpences.
*Facit* 720*d.* ; 240 *threepences* ; 120 *ſixpences.*

15. Reduce 12600d. into groats, ſhillings, and crowns.
*Facit* 3150 *gr.* ; 1050*s.* ; 210 *cr.*

16. Reduce 5160 groats into ſhillings, crowns and pounds.
*Facit* 1720*s.* ; 344 *cr.* ; 86*l*

17 How many ſhillings, and guineas are in 4284 pence ?
*Anſ.* 357*s.* ; 17 *guineas.*

18. How many crowns and pounds are in 1120 ſixpences ?
*Anſ.* 112 *cr.* ; 28*l.*

## *Reduction Aſcending and Deſcending.*

1. In 720 ſhillings, how many pence and crowns ?
*Anſ.* 8640*d.* 144 *crowns.*

720s.
12

6|0)864|0(144

2. In 120 ſhillings, how manycrowns and half crowns ?
*Anſ.* 24 *cr.* ; 48 *half-cr.*

3. In 60 crowns how many ſhillings and pounds ?
*Anſ.* 300*s.* ; 15*l.*

4. In 612 half crowns, how many crowns and pence ?
*Anſ.* 306 *cr* ; 18360*d.*

5. In 40 guineas, how many ſhillings, crowns and pounds?
*Anſ.* 840*s.* ; 168 *cr.* ; 42*l.*

6. Reduce 12600 pence into ſhillings, groats and crowns ?
*Facit* 1050*s.* 3150 *gr.* ; 210 *cr.*

7. Reduce 63 crowns into ſhillings and guineas ?
*Facit* 315*s.* ; 15 *guin.*

8. Reduce 70 moidores into pounds ? *Facit* 94*l* ; 10*s.*

9. Reduce 12180 threepences into ſhillings, pence and groats ? *Facit* 3045*s.* ; 36540*d.* 9135 *gr.*

10. How many crowns, groats and pounds are in 1720s. ?
*Anſ.* 344 *cr.* ; 5160 *gr.* ; 86*l.*

11. How many groats, threepences and ſixpences are in 121 ſhillings ? *Anſ.* 363 *gro.* ; 484 *threepences* ; 242 *ſixpences.*

12. How many pounds and crowns are in 1120 ſixpences ?
*Anſ.* 28*l.* ; 112 *cr.*

13. How many crowns, half-crowns, and ſhillings are in 280l. and the number of each equal ?
*Anſ.* 658, *and* 7*s.* *over.*

14. Four men brought each 17l. 10s. value in gold into the mint to be coined into guineas,—how many muſt they have? *Anſ.* 16 *guin.* 14*s.* *each.*

15. There are 12 purſes with each 12 guineas,—how much ſterling is the ſum? *Anſ* £ 151 : 4*s.*

16. A certain ground-tenant was behind with his landlord for 16 years rent, at 5l. 10s. a year,—how much was the debt? *Anſ.* £ 88.

17. There are 34l. 17s. to be divided amongſt 17 men,—how much is it a piece? *Anſ.* £ 2 : 1*s.*

18. In 19 moidores,—how many pounds ſterling? *Anſ.* £ 25 : 13*s.*

## *Of Troy Weight.*

1. In 47 lb. 10 oz—how many grains? *Anſ.* 275520 *gr.*

2. In 47128 grains of gold,—how many lb. *Anſ.* 8 *lb.* 2 *oz.* 3 *dwt.* 16 *gr.*

3. In 10 lb. of ſilver,—how many ſpoons, each 5 oz. 10 dwts.? *Anſ.* 21 *ſpoons, and* 90 *dwts. over.*

4. In 4560 grains of gold,—how many tea ſpoons, each half an ounce? *Anſ.* 19 *tea-ſpoons.*

5. In 47 ſalvers, each 20 oz—how many lb? *Anſ.* 78 *lb.* 4 *oz.*

6. How many porringers, each 11 oz. are in 19 lb. 10. oz. 11 dwts. of ſilver? *Anſ.* 21 *porringers*, and 151 *dwts. over.*

7. A goldſmith having 3 ingots of ſilver, each weighing 27 oz. was minded to make them into ſpoons of 2 oz. cups of 5 oz. ſalts of 1 oz. and ſnuff-boxes of 2 oz. and to have an equal number of each; the queſtion is, what was that number? *Anſ.* 8 *of each ſort, and* 1 *oz. over.*

8. In 17 ingots of ſilver, each 27 oz. 10 dwts—how many grains? *Anſ.* 224400 *gr.*

## *Of Avoirdupois Weight.*

Q. Which are the allowances uſually made in Avoirdupois great Weight to the buyer?

A. They are Tare, Tret, and Cloff.

Q. What is Tare?

A. Tare is an allowance made to the buyer for the weight of the box, bag, veſſel, or whatever elſe contains the goods bought; and is either,

1. At ſo much per bag, barrel, box, &c.
2. At ſo much per cent. or,
3. At ſo much in the groſs weight, called invoice tare.

Q. What is Tret?

A. Tret is an allowance made by the merchant to the buyer of 4lb. in 104lb that is, the ſix and twentieth part, for the waſte and duſt, in ſome ſorts of goods.

Note, If an allowance be made both for Tare and Tret in the ſame parcel of goods, the Tare is firſt to be deducted: and that remainder is called ſuttle weight.

Q. What is Cloff?

A. Cloff is an allowance of 2lb. weight to the citizens of London, on every draught above 3 cwt. on ſome ſorts of goods, as Galls, Madder, Sumac, Argol, &c.

Q. What are theſe allowances called beyond the ſeas?

A. They are called the Courteſies of London; becauſe they are not practiſed in any other place.

Q. What is Groſs Weight?

A. Groſs is the weight of any ſort of merchandize, and that which contains it, being weighed both together.

Q. What is Neat Weight?

A. Neat is the pure weight of the goods, after all allowances are deducted.

Note 1. Raw, long, ſhort, China, Morea ſilk, &c. are weighed by a great pound of 24 oz. But Ferret, Filoſella, ſleeve ſilk, &c. by the common pound of 16 oz.

2. To bring great pounds into common, multiply by 3, and divide by 2.

3. To bring common pounds into great, multiply by 2, and divide by 3.

## CASE I.

### Examples.

1. In 7 cwt. 3 qrs. 10lb—how many oz. and drams? *Anſ.* 14048 *oz.* 224768 *dr.*

2. In 3 tons of iron,—how many cwt. qrs and lb? *Anſ.* 60 *cwt.* 240 *qrs.* 6720 *lb.*

3. In 14048 oz—how many cwt? *Anſ.* 7 *cwt.* 3 *qrs.* 16 *lb.*

4. In 6720 lb. of iron, how many tons? *Anſ.* 3 *tons,*

5. In 461 great pounds of Morea ſilk,—how many oz. and drams? *Anſ.* 11064 *oz.* 177024 *dr.*

6. In 40426 drams of ſilk,—how many great pounds? *Anſ.* 105 *great pounds,* 6 *oz.* 10 *dr.*

7. In 3 lb of cinnamon, how many parcels, each 12 oz? *Anſ.* 4 *parcels.*

8. In 470 parcels of ſugar, each 26 lb—how many cwt? *Anſ.* 109 *cwt.* 0 *qrs,* 12 *lb.*

9. In 672 great pounds of ſilk, how many common pounds? *An.* 1008 *common pounds.*

10. In 480 common pounds of ſilk, how many great pounds? *An.* 320 *great lb.*

11. In 8 hogſheads of tobacco, each weighing neat $7\frac{1}{2}$ cwt. how many pounds? *An.* 6720 *lb.*

12. In 17 pigs of lead, each weighing $4\frac{3}{4}$ cwt. how many fother, at $19\frac{1}{2}$ cwt. *An.* 4 *fother,* 2 *cwt.* 3 *qr.*

13. In 712 cwt. of lead, how many fother? *An.* 36 *fother,* 10 *cwt.*

14. In 17 cwt. 1 qr. 6 lb. of ſugar, how many parcels, each 17lb? *Anſ.* 114 *parcels.*

## CASE II.

## *Of Tare and Tret, &c.*

Note, If the teacher approve of it, he may introduce this and the following caſes after practice, inſtead of this place.

Q. When the tare is at ſo much per barrel, bag, &c. how is the neat weight found?

A. Multiply the number of the ſaid barrels, bags, &c. by the tare, and ſubtract the product from the groſs, the remainder is the neat.

Note, 1. The table of allowance for tare, in the book of rates ſays:

For CYPRUS and SMYRNA ſilk.

| | | | |
|---|---|---|---|
| Bales | about or above 300lb. | The tare per bale is | 16 |
| | from 300 to 200. | | 14 |
| | from 100 downwards. | | 12 |

For VIRGINIA Tobacco.

| | | | |
|---|---|---|---|
| Hhds. | 5 cwt. and upwards | The tare per hhd. is | 100 |
| | from 5 to 4 cwt. | | 90 |
| | from 4 to 3 cwt. | | 80 |
| | under 3 cwt. | | 70 |

Sugar from INDIA.

| | | |
|---|---|---|
| In caſks and canniſters, | Tare | 1-6th |
| In cheſts and caſks from St. Thome, | | 1-5th |

Oil from Canada,
Tare 29 lb. per barrel.

Note 2, $7\frac{1}{2}$ lb. of oil make a gallon; therefore to reduce pounds into gallons, multiply by 2, and divide by 15.

### EXAMPLES.

1. In 16 hogſheads of tobacco, each 5 cwt. 1 qr. 19 lb. groſs, tare per hogſhead 100 lb.—how much neat weight? *An.* 72 *cwt.* 1 *qr.* 20 *lb.*

**Q.** What is Tret?

**A.** Tret is an allowance made by the merchant to the buyer of 4lb. in 104lb that is, the ſix and twentieth part, for the waſte and duſt, in ſome ſorts of goods.

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| | | *cwt.* | *qr.* | *lb.* | |
|---|---|---|---|---|---|
| | | 5 | 1 | 19 | |
| | | | | 4 | by the parts. |
| 16 | | 21 | 2 | 20 | |
| 100 | | | | 4 | |
| 4 | *cwt.* *qr.* *lb.* | | | | |
| 28) 1600 (57 ( | 14 1 4 *groſs* | 86 | 2 | 24 | |
| | *tare* | 14 | 1 | 4 | |
| | *neat* | 72 | 1 | 20 | |

2. In 70 bales of Smyrna ſilk, each 317lb. groſs, tare per bale 16lb—how many lb. neat? Anſ. 21070 *lb neat.*

3. In 14 hogſheads of tobacco, weighing groſs, 89 cwt. 3 qrs. 17lb. tare per hogſhead 100lb.—how much neat weight? Anſ. 77 *cwt.* 1 *qr.* 17*lb.*

4. What is the neat weight of 30 bales of Cyprus ſilk, each weighing 249lb. groſs, tare per bale 14lb? Anſ 7050 *lb.*

### Caſe III

Q. When the tare is at ſo much per cent. how is the neat weight found?

A. When the tare is an aliquot part or parts of the cwt. divide the whole groſs by the ſaid part or parts that the tare is of an cwt. and the quotient thence ariſing gives the tare of the whole; which ſubtract from the whole groſs, the remainder is neat.

*Note* 1. Figs, almonds, argol, &c. - - - 14 lb }
Caroteels, butts of currants, &c. 16 } per cent.
Oil in uncertain caſks, &c. - - 18 }

2. Whatever part the given tare is of an cwt. the ſame muſt the whole tare be of the given groſs weight.

### Examples.

1. What is the neat weight of 12 barrels of argol, groſs 48 cwt. 3 qrs. 12 lb. tare 14lb. per cent? Anſ. 42 *cwt.* 3 *qrs.*

| | *C.* | *qrs.* | *lb.* |
|---|---|---|---|
| $14=\frac{1}{8}$) | 48 | 3 | 12 *groſs.* |
| | 6 | 0 | 12 *tare.* |
| | 42 | 3 | 0 *neat.* |

2. In 12 butts of currants, each 7 cwt. 1 qr. 10lb. groſs, tare per cent. 16lb.—how much neat weight?

Anſ. 75 *cwt.* 1 *qr.* 26 *lb.* 14 *oz.*

3. What is the neat Weight of 30 barrels of figs, each 2 cwt. 3 qrs. groſs, tare per cent. 14 lb ? Anſ. *72 cwt. 21lb.*

Note, When the tare is not the aliquot part or parts of an cwt. then multiply the pounds groſs by the tare per cent given, and that product divided by 112, the quotient is the whole tare, which ſubtract from the groſs, the remainder is neat.

4. What is the neat produce of 20 barrels of anchovies. each groſs 33lb. tare per cent. 10lb ? Anſ. 601*lb.* 9 *drs.* 1 *oz.*

5. What is the neat produce of 17 barrels of pot-aſh, each groſs 203lb. tare 10 lb. per cent ? Anſ. 3142 *lb.* 14 *oz.*

### CASE IV.

Q. When the tare is at ſo much in the whole groſs weight, how is the neat weight found ?

A. Subtract the tare from the groſs, and the remainder is neat.

Examples.

1. What is the neat weight of 38 hogſheads of tobacco, weighing groſs 201 cwt. 3 qrs. 12 lb. tare in the whole 3140 lb. ? Anſ. 173 *cwt.* 3 *qrs.* 8 *lb.*

2. What is the neat weight of 3 hogſheads of tobacco, weighing as follows, *viz.*

| | *cwt.* | *qrs* | *lb.* | | *lb.* |
|---|---|---|---|---|---|
| No. 1. | 3 | 1 | 2 | Tare | 80 |
| 2. | 3 | 2 | 1 | | 90 |
| 3. | 5 | 1 | 12 | | 100 |

Anſ. 9 *cwt.* 2 *qrs.* 25*lb.*

### CASE V.

Q. How is the neat weight found, when tret is allowed with tare ?

A. Divide the pounds ſuttle by 26, the quotient is the tret, which ſubtract from the ſuttle, the remainder is neat.

Examples.

1. In 8 cwt. 3 qrs. 20 lb. groſs, tare 38 lb. Tret 4lb. per 104 lb.—how many lb. neat ? Anſ. 925 *lb. neat.*

2. In 177 cwt 0 qrs. 22 lb groſs, tare 9 lb. per cent. tret 4 lb. per 104lb.—how many cwt. neat ?

Anſ. 156 *cwt.* 2 *qrs.* 22 *lb.*

3. In 17 cheſts of ſugar, weighing 120 cwt. 2 qrs. groſs, tare 176 lb. tret 4 lb. per 104 lb.—how many cwt. neat ?

Anſ. 114 *cwt.* 1 *qr.* 12 *lb.*

Note, There are other allowances, not ſo common, ſuch as break, which is at ſo much per barrel, bag, &c. and damage, which is ſo much in the whole, but they are very eaſy.

## *Of Apothecaries Weight.*

1. In 12 ℔ 1 ℥ 2 ʒ 0 ℈ 1 gr.—how many grains ?

Anſ. 69721 *grains.*

2. In 69721 grains,—how many ℈ ʒ ℥. and ℔.
*Anſ.* 12 ℔. 1 ℥. 2 ʒ. 0 ℈. 1 *gr.*

## *Of Long Meaſure.*

1. In 70 miles,—how many furlongs and poles?
*Anſ.* 560 *furlongs*, 22400 *poles.*

2. In 40 yards,—how many feet, inches, and barley-corns? *Anſ.* 120 *feet*, 1440 *inches*, 4320 *barley corns.*

3. In 5 miles,—how many barley corns?
*Anſ.* 950400 *barley-corns.*

4. In 4000 inches,—how many yds? *Anſ.* 111 *yd.* 4 *in.*

5. In 4 leagues,—how many yds? *Anſ.* 21120 *yd.*

6. In 15840 yards,—how many miles and leagues?
*An.* 9 *miles.* 3 *leagues.*

7. How many barley-corns in a mile?
*An.* 190080 *barley corns.*

8. How many times doth the wheel which is 18 feet 6 inches round, turn between London and York, which is 150 miles? *An.* 42810 *Times, and* 180 *in. over.*

9. How many barley-corns will reach round the globe of the earth, which is 360 degrees, and each degree 69½ miles.
*An.* 4755801600 *barley-corns.*

## *Of Cloth Meaſure.*

1. In 14 yards, how many quarters and nails?
*An.* 56 *qr.* 224 *na.*

2. In 17 yds, 1 qr. 2 na. how many nails? *An.* 278 *na.*

3. In 4712 nails, how many yds? *An.* 294 *yds.* 2 *qrs.*

4. In 47128 nails of Iriſh Cloth,—how many pieces, each 12 yards? *An.* 245 *pieces.* 5 *yd.* 2 *qrs.*

5. In 4 pieces of cloth, each 14 yards,—how many quarters and nails? *An.* 224 *qr.* 896 *na.*

6. In 10 bales of cloth, each 10 pieces, each 12 yards,—how many yards? *An.* 1200 *yd.*

7. In 7000 nails of Holland, how many ells? *An.* 350 *ells.*

8. Reduce 42 ells into quarters and nails.
*Facit* 210 *qr.* 840 *na.*

## *Of Land Meaſure.*

1. In 40 acres,—how many roods and perches?
*An.* 160 *roods*, 6400 *perches.*

2. In 17 a. 3 r. 10 p. how many perches? *An.* 2850 *per.*

3. Reduce 2850 perches into acres. *Facit* 17 *a.* 3 *r.* 10 *p.*

4. If a piece of ground contains 24 acres, and an incloſure of 17 acres 3 roods be taken out of it,—how many perches are there in the remainder? *An.* 1000 *perches.*

5. One field contains 7 acres, another 10 acres, and a third 12 acres, 1 rood,—how many ſhares of 76 perches each are contained in the whole? *Anſ.* 61 *ſhares and* 44 *perches over.*

## Of Liquid Meaſure.

1. In 17 gallons,—how many quarts and pints?
*Anſ.* 68 *qts.* 136 *pints.*

2. In 10 barrels of beer, how many gallons and quarts?
*Anſ.* 360 *gallons*, 1440 *qts.*

3. In 4 barrels of ale, how many gallons? *Anſ.* 128 *gal.*

4. In 72 hogſheads of beer,—how many barrels?
*Anſ.* 108 *barrels.*

5. In 91 barrels of beer,—how many hogſheads?
*Anſ.* 60 *hogsheads* 36 *gal.*

6. If a back contains 36 barrels of beer,—how many gallons doth it hold? *Anſ.* 1080 *gal.*

7. In 4 tons of oil,—how many hogſheads, gallons and quarts? *Anſ.* 16 *hogsheads*, 1008 *gal.* 4032 *qts.*

8. In 3 hogſheads of brandy, how many half-anchors?
*Anſ.* 37 *half-anchors*, 4 *gal.*

9. In 1712 gallons of wine,—how many hogſheads?
*Anſ.* 27 *hogsheads*, 11 *gal.*

10. If a vintner be deſirous to draw off a pipe of Canary into bottles, containing pints, quarts, and two quarts, and of each an equal number,—how many muſt he have?
*Anſ.* 144 *of each ſort.*

## Of Dry Meaſure.

1. In 40 quarters of wheat, how many buſhels and pecks?
*Anſ.* 320 *bush.* 1280 *pecks.*

2. Reduce 1280 pecks of wheat into quarters, *Facit* 40 *qrs.*

3. In 30 chaldron of coals, each 36 buſhels,—how many pecks? *Anſ.* 4320 *pecks.*

4. Reduce 7094 pecks of coals into chaldrons.
*Facit* 49 *chaldrons*, 9 *buſh.* 2 *pecks.*

## Of Time.

1. In 121812 ſeconds,—how many hours?
*Anſ.* 33 *hours*, 50 *min.* 12 *ſec.*

2. Reduce 41 weeks into days, hours and minutes.
*Facit* 287 *days*, 6888 *hours*, 413280 *min.*

3. Reduce 413280 minutes into weeks. *Facit* 41 *weeks.*

4. How many ſeconds in a year, allowing it to be 365 days, 6 hours? *Anſ* 31557600 *ſec.*

5. How many days have paſſed ſince the birth of Chriſt to Chriſtmas, 1791? *Anſ.* 654162 *days* 18 *hours.*

6. From March 2 to November 19 following (incluſive) how many days? *Anſ.* 263 *days.*

## *Of Motion.*

In half a year's time the ſun makes his progreſs through 6 ſigns of the Zodiac, how many degrees, minutes, and ſeconds doth that amount to?

*Anſ.* 180 *deg.* 10800 *min.* 648000 *ſec.*

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## Of the Single Rule of THREE.

Q. HOW many parts are there in the Rule of Three?

A. Two: Single or Simple, and Double or Compound.

Q. By what is the Single Rule of Three known?

A. By three terms, which are always given in the queſtion to find a fourth.

Q. Are any of the terms given to be reduced from one denomination to another?

A. If any of the given terms be of ſeveral denominations they muſt be reduced into the loweſt denomination mentioned.

Q. What do you obſerve concerning the firſt and third terms?

A. They muſt be of the ſame name and kind.

Q. What do you obſerve concerning the fourth term?

A. It is of the ſame name and kind with the ſecond.

Q. What do you obſerve of three given terms taken together?

A. That the two firſt are a ſuppoſition and the laſt is a demand.

Q. How is the third term known?

A. It is known by theſe or the like words, What coſt? How many? How much?

Q. How many ſorts of Proportion are there?

A. Two; Direct and Inverſe

### 1. *Of Direct Proportion.*

Q. What is direct Proportion?

A. Direct Proportion is when more requires more, or leſs requires leſs.

Q. What do you mean by more requires more?

A. More requires more, is when the third term is greater than the firſt; and therefore requires the fourth term to be greater than the ſecond in the ſame proportion.

Q. What do you mean by leſs requires leſs?

A. Leſs requires leſs, is when the third term is leſs than the firſt; and therefore requires the fourth term to be leſs than the ſecond in the like proportion.

Q. How is the fourth term in direct proportion found?

A. By multiplying the ſecond and third terms together, and dividing that product by the firſt term.

Q. What proportion does the fourth Number bear to any other?

A. It bears the ſame proportion to the ſecond, as the third does to the firſt.

Q How do you prove queſtions in the Rule of Three Direct?

A. By changing their order.

EXAMPLES.

1. If 3 oz. of ſilver coſt 17s. what will 48 oz. coſt?

```
         oz.  s.  oz.                 Anſ. £ 13 : 12s.
      As 3 : 17 :: 48
                   17
                   —    2|0   l.   s.
               3)816(27|2(13    12
```

2. If 3 lb of ginger coſt 3s. what coſt 26lb? *Anſ.* £ 1 : 6

3 If 2 oz. of ſilk coſt 2s. 6d.—what coſt 7lb? *Anſ.* £ 7.

4. If 1 gallon of ale coſt 8d.—what coſt 36 gallons? *Anſ.* £ 1 : 4*s.*

5. If 1 lb. of ſugar coſt $4\frac{1}{2}$d. what coſt 48 lb? *Anſ.* 18*s.*

6. If 1 lb. of ſugar coſt 4d. what coſt 1 cwt? *Anſ.* 1 : 17 : 4.

7. If 1 cwt. of ſugar coſt 2l. 12s. what coſt 1 lb? *Anſ.* 5*d.* $2\frac{32}{112}$ *qrs*

8. If 1 gallon of beer coſt 4d. what coſt a barrel? *Anſ.* 12*s*

9. If 1 pair of ſtockings coſt 2s. 3d. what coſt 19 dozen pair? *Anſ.* £ 25 : 13*s.*

10. If 19 dozen pair of ſhoes coſt 25l. 13s what coſt 1 pair? *Anſ.* 2*s.* 3*d.*

11. Bought a firkin of butter, containing 56lb. for 18s. 8d. what is that per lb? *Anſ.* 4*d.*

12. Sold 3 cwt. of tobacco, at 18d. per lb. what is the price of the whole? *Anſ.* £ 25 : 4*s.*

13. Bought 19 chaldrons of coals, at 29s. 6d. per chaldron, what come they to? *Anſ.* £ 28 : 0 : 6.

14. If 1 lb. of ſugar coſt 9d. what coſt 17 cwt. 2 qrs? *Anſ.* £ 73 : 10*s.*

15. If 1 oz. of ſilver coſt 5s. 6d. what is the price of a tankard that weighs 1 lb. 10 oz. 10 dwts. 4 grains? *Anſ.* £ 6 : 3 : 9*d.* $2\frac{96}{480}$*qrs.*

16. If 1 lb. of tobacco coſt 15d. what coſt 3 hogſheads, weighing together 15 cwt. 1 qr. 19 lb? *Anſ* £ 107 : 18 : 9.

17. If a yard of cloth is worth 14s. what is the worth of 5 pieces, each 19 yards? *Anſ.* £ 66 : 10*s.*

18. If an ell of Holland coſt 4s. 6d. what is the value of 5 pieces, each 12 ells? *Anſ.* £ 13 : 10*s.*

19. If a buſhel of coals coſt 10d. how many chaldrons for 100l? *Anſ.* 66 *ch.* 24 *buſh.*

20. How many quarters of corn for 40 guineas, at 4s per. buſhel? *An.* 26 *qrs.* 2 *buſh.*

21. If a man's yearly income be 300l. what is it per day? *An.* 16*s.* 5d. $1\frac{15}{305}$ *qrs.*

22. If a man ſpends 7d. *per* day, how much is that in a year? *An.* £ 10 : 12 : 11.

23. If a pint of wine coſt 10d. what coſt 3 hogſheads? *An.* £ 63.

24. If a pipe of Canary coſt 40l. how much is that *per* pint? *An.* 9d. $2\frac{96}{1008}$ *qrs.*

25. Bought 12 pieces of cloth, each 12 yards at 10s. 6d. *per* yard, what come they to? *An.* £ 75 : 12*s.*

26 What coſt 120 yards of cloth, at 3s. *per* yard? A*n.* £ 18.

27. A merchant bought 4 pieces of Holland, each 12 ells for 7l. 10s.—what did 1 ell coſt? A*n.* 3*s.* : $1\frac{1}{2}$d.

28. A grocer bought 3 hogſheads of ſugar, each 10 cwt. 3 qrs. 12 lb. groſs, tare 26 lb. *per* hhd. at $2\frac{1}{2}$d. *per* lb.—I demand what the 3 hogſheads came to? A*n.* £ 37 : 3 : 9.

29. How much muſt I pay for the carriage of $10\frac{1}{2}$ cwt. at the rate of $1\frac{1}{2}$d. *per* lb? A*n.* £ 7 : 7*s.*

30. If 6 horſes eat up 21 buſhels of oats in a week's time, how many buſhels will ſerve 20 horſes the ſame time? A*n.* 70 *buſh.*

31. If a family of ten perſons ſpend 3 buſhels of malt in a month, how many buſhels will ſerve them when they are 30 in a family? A*n.* 9 *buſh.*

32. If an ingot of ſilver weighs 36 oz. 10 dwts what is it worth at 5s. per oz? A*n.* £ 9 : 2 : 6.

33. How many yards of lace for 100l. at 3s. 6d. per yard? A*n.* $571\frac{18}{42}$ *yards.*

34. If a merchant hath owing to him 1000l. and his debtor doth agree to pay him for every pound 12s. 6d.—I demand how much he muſt pay in all? A*n.* £ 625.

35. A goldſmith ſold a tankard for 10l. 12s. at the rate of 5s. 4d. per oz. I demand the weight of it? A*n.* 39 *oz.* 15 *dwts.*

36. A man bought a piece of cloth for 16l. 10s. at 15s. per yard, how many yards did it contain? A*n.* 22 *yards.*

37. If 1 cwt. of cheeſe coſt 37s. 4d. what is that per lb? An. 4*d.*

38. Coals at 33s. per chaldron, how much per buſhel? A*n* 11*d.*

39. What coſt 49392 caſe knives, at 4s. 4d. *per* dozen?
*Anſ.* £ 891 : 16*s*.

40. If a gentleman has an eſtate of 245l. 10s. a year,—how much may he ſpend one day with another, to lay up 60 guineas at the year's end? *Anſ.* 10*s. per day*.

41. If 17 cwt. 3 qrs. 17 lb. of tobacco coſt 133l 13s. 4d. what coſt 1 oz.? *Anſ.* 1*d.*

42. If 1 cwt. of lead coſt 15s, 11d—what coſt 5 fother?
*Anſ.* £ 77 : 11*s* : $10\frac{1}{2}$.

43. When the ton of wine coſt 42l—what coſt 1 quart?
*Anſ.* 10*d.*

44. At a noble *per* week, how many months board may I have for 50l.? *Anſ.* 37 *months*, 2 *weeks.*

45. What coſt a peck of wool, weighing 2 cwt. 1 qr. 19lb. at 8s. 6d. *per* ſtone? *Anſ.* £ 8 : 4 : 6*d.* $1\frac{10}{14}$ *qrs.*

46. What is cheeſe *per* cwt. $3\frac{1}{2}$d. *per* lb? *Anſ.* £ 1 : 12 : 8.

47. If a yard of cambric coſt 12s—what coſt 4 pieces each 20 yards? *Anſ.* £ 48.

48. If a yard of broad cloth coſt 18s.—what coſt 5 pieces each 20 yards? *Anſ.* £ 90.

49. If lead be ſold for $1\frac{1}{2}$d. *per* lb—what is 3 cwt. worth?
*Anſ.* £ 2 : 2.

50. If coffee be ſold for $8\frac{1}{4}$d. *per* oz—what is 6 cwt. worth?
*Anſ.* £ 369 : 12*s.*

## (2.) *Of Inverſe Proportion.*

Q. What is Inverſe Proportion?

A. Inverſe Proportion is when more requires leſs, or leſs requires more.

Q. What is meant by more requires leſs?

A. More requires leſs, is when the third term is greater than the firſt, and requires the fourth term to be leſs than the ſecond.

Q. What is meant by leſs requires more?

A. Leſs requires more, is when the third term is leſs than the firſt, and requires the fourth term to be greater than the ſecond.

Q. How is the fourth term in Inverſe Proportion found?

A. By multiplying the firſt and ſecond terms together, and dividing that product by the third term.

Q. What proportion does the fourth term bear to any of the reſt?

A. It bears ſuch proportion to the ſecond, as the firſt does to the third.

## EXAMPLES.

1. If 48 men can build a wall in 24 days,—how many men can do the ſame in 192 days? *Anſ.* 6 *men.*

2. If I lent my friend 100l. for 6 months (allowing the month to be 30 days)—how long ought he to lend me 1000l. to requite my kindneſs? *Anſ.* 18 *days.*

3. If 100l. in 12 months gain 6l. intereſt,—what principal will gain the ſame in 8 months? *Anſ.* £ 150.

4. If a footman performs a journey in 3 days, when the days are 16 hours long,—how many days will he require of 12 hours long to go the ſame journey in? *Anſ* 4 *days.*

5. How many yards of matting that is half a yard wide, will cover a room that is 18 feet wide, and 30 feet long? *Anſ.* 120 *yards.*

6. If 28s. will pay for the carriage of an cwt. 130 miles,—how far may 6 cwt be carried for the ſame money? *Anſ.* 25 *miles.*

7. How much in length, that is 3 inches broad will make a foot ſquare? *Anſ.* 48 *inches.*

8. If 15 ſhillings worth of wine will ſerve 46 men, when the tun is worth 12l—how many will the ſame 15 ſhillings worth ſuffice, when the tun is worth but 8l? *Anſ.* 69 *men.*

9 If, when the price of a buſhel of wheat is 6s. 3d. the penny-loaf will weigh 9 oz—what muſt the penny-loaf weigh when wheat is at 4s. 6d. *per* buſhel? *Anſ.* 12 *oz.* 10 *dwts.*

10. Suppoſe 800 ſoldiers were placed in a garriſon, and their proviſions were computed ſufficient for 2 months;—how many ſoldiers muſt depart that the proviſions may ſerve them 5 months? *Anſ.* 480 *men.*

11. There is a ciſtern having a cock, which will empty it in 12 hours; I demand how many cocks of the ſame capacity there muſt be to empty it in a quarter of an hour? *Anſ.* 48 *cocks.*

12. There was a certain building raiſed in 8 months by 120 workmen, but the ſame being demoliſhed it is required to be rebuilt in 2 months. I demand how many men muſt be employed about it? *Anſ.* 480 *Men.*

13. A piece of tapeſtry is 3 ells Flemiſh wide, and 4 ells Flemiſh long, and it is required to be lined with ſomething that is but 3 quarters of a yard wide;—I demand how many yards there muſt be to complete the lining? *Anſ.* 9 *yards.*

## OF PRACTICE.

Q. WHAT is Practice?

A. It is a ſhort way of finding the value of any quantity of goods, by the given price of one integer.

Q. How do you prove queſtions in Practice?

A By the Single Rule of Three Direct: Or Practice may be proved by itſelf, by varying the parts.

### *The Tables.*

| *s.* | *d.* | *l.* | *s.* | *d.* | *l.* | *s.* | *d.* | *Cwt.* | *lb.* |
|---|---|---|---|---|---|---|---|---|---|
| $\frac{1}{2}$ is | 6 | $\frac{1}{2}$ is | 10 | 0 | $\frac{1}{15}$ | 1 | 4 | $\frac{1}{2}$ is | 56 |
| $\frac{1}{3}$ | 4 | $\frac{1}{3}$ | 6 | 8 | $\frac{1}{16}$ | 1 | 3 | $\frac{1}{4}$ | 28 |
| $\frac{1}{4}$ | 3 | $\frac{1}{4}$ | 5 | 0 | $\frac{1}{20}$ | 1 | 0 | $\frac{1}{7}$ | 16 |
| $\frac{1}{6}$ | 2 | $\frac{1}{5}$ | 4 | 0 | $\frac{1}{30}$ | 0 | 8 | $\frac{1}{8}$ | 14 |
| $\frac{1}{8}$ | $1\frac{1}{2}$ | $\frac{1}{6}$ | 3 | 4 | $\frac{1}{40}$ | 0 | 6 | $\frac{1}{14}$ | 8 |
| $\frac{1}{12}$ | 1 | $\frac{1}{8}$ | 2 | 6 | $\frac{1}{60}$ | 0 | 4 | $\frac{1}{16}$ | 7 |
|  |  | $\frac{1}{10}$ | 2 | 0 | $\frac{1}{80}$ | 0 | 3 |  |  |
|  |  | $\frac{1}{12}$ | 1 | 8 | $\frac{1}{120}$ | 0 | 2 |  |  |

## CASE I.

Q. What muſt be done with the price of an Integer, when it is leſs than a penny?

A. Find the aliquot parts of that price contained in a penny, which muſt be diviſors to the given ſum; that is, if the price be a farthing, ſay a farthing is the fourth of a penny, and ſet it thus, $|\frac{1}{4}|\frac{1}{4}|$. If the price be a halfpenny, then ſay a halfpenny is the half, thus, $|\frac{1}{2}|\frac{1}{2}|$. If it is three farthings, then ſay a halfpenny is the half of a penny, and a farthing is the fourth of a penny, thus, $\left|\begin{array}{c|c} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{4} & \frac{1}{4} \end{array}\right|$

Q. What do you obſerve concerning theſe Columns?

A. The firſt column contains the money and the other the parts.

Note, 1. When there are more aliquot parts than one, their quotients muſt be added together, and the ſum, if the firſt aliquot part be taken from a penny, will be pence: If it be taken from a ſhilling, will be ſhillings; or if it be taken from a pound, will be pounds.

2. It is frequently better to take parts of parts than parts of the whole price; and then the three farthings above-mentioned may as well be taken thus, $\left|\begin{array}{c|c} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{4} & \frac{1}{2} \end{array}\right|$ that is, a halfpenny is the half of a penny; and a farthing is the half of a halfpenny.

| | | |
|---|---|---|
| $\frac{1}{4}$ | $\frac{1}{4}$ | 7612 at $\frac{1}{4}$ |
| | 12 | 1903 |
| | 2\|0 | 15\|8 : 7 |
| | | £ 7 : 18 : 7 |

| | | |
|---|---|---|
| $\frac{1}{2}$ | $\frac{1}{2}$ | 6812 at $\frac{1}{2}$ |
| | 12 | 3406 |
| | 2\|0 | 28\|3 : 10 |
| | | £ 14 : 3 : 10 |

| | | |
|---|---|---|
| | | 4712 at $\frac{3}{4}$ |
| $\frac{1}{2}$ | $\frac{1}{2}$ | 2356 |
| $\frac{1}{4}$ | $\frac{1}{4}$ | 1178 |
| | 12 | 3534 |
| | 2\|0 | 29\|4 : 6 |
| | | £ 14 : 14 : 6 |

1280 at $\frac{1}{4}$

*Facit* £ 1 : 6 : 8

7672 at $\frac{1}{2}$

*Facit* £ 15 : 19 : 8

9180 at $\frac{3}{4}$

*Facit* £ 28 : 13 : 9

## CASE II.

Q. What muſt be done with the price of an Integer when it is leſs than a ſhilling?

A. Find the aliquot parts of that price contained in a ſhilling, which muſt be diviſors to the given ſum. Or thus,

If the given price be not the aliquot part of a ſhilling, then firſt take ſome part of it that is an aliquot part, and for the remaining part of the price, let it be taken out of the foregoing part or parts, and then add the quotients together as before; the total will be the anſwer in ſhillings.

### Examples.

| | | |
|---|---|---|
| 1 | $\frac{1}{12}$ | 7612 at 1d. |
| | 2\|0 | 63\|4 : 4 |
| | | £ 31 : 14 : 4 |

| | | |
|---|---|---|
| 1 | $\frac{1}{12}$ | 8612 at 1$\frac{1}{4}$d. |
| $\frac{1}{4}$ | $\frac{1}{4}$ | 717 : 8 |
| | | 179 : 5 |
| | 2\|0 | 89\|7 : 1 |
| | | £ 44 : 17 : 1 |

6812 at 1d.

*Facit* £ 28 : 7 : 8

1861 at 1d.

*Facit* £ 9 : 13 : 10$\frac{1}{4}$

4121 at 1$\frac{1}{4}$

*Facit* £ 21 : 9 : 3$\frac{1}{4}$

1861 at 1¾d.

*Facit* £ 13 : 11 : 4¾

4761 at 2d.

*Facit* £ 39 : 13 : 6

6181 at 2¼d.

*Facit* £ 57 : 18 : 11¼

1218 at 2½d.

*Facit* £ 12 : 13 : 9

8012 at 2¾d.

*Facit* £ 91 : 16 : 1

7612 at 3d.

*Facit* £ 95 : 3

6128 at 3¼d.

*Facit* £ 82 : 19 : 8

6180 at 3½d.

*Facit* £ 90 : 2 : 6

7812 at 3¾d.

*Facit* £ 122 : 1 : 3

8120 at 4d.

*Facit* £ 135 : 6 : 8

7000 at 4¼d.

*Facit* £ 123 : 19 : 2

6001 at 4½d.

*Facit* £ 112 : 10 : 4½

7121 at 4¾d.

*Facit* £ 140 : 18 : 8¾

7181 at 5d.

*Facit* £ 149 : 12 : 1

8121 at 5¼d.

*Facit* £ 177 : 12 : 11¼

6128 at 5½d.

*Facit* £ 140 : 8 : 8

6100 at 5¾d.

*Facit* £ 146 : 2 : 11

1000 at 6d.

*Facit* £ 25

7610 at 6¼d.

*Facit* £ 198 : 3 : 6½

1218 at 6½d.

*Facit* £ 32 : 19 : 9

6000 at 6¾d.

*Facit* £ 168 : 15

7101 at 7d.

*Facit* £ 207 : 2 : 3

1001 at 7¼d.

*Facit* £ 30 : 4 : 9¼

4100 at 7½d.

*Facit* £ 128 : 2 : 6

6120 at 7¾d.

*Facit* £ 197 : 12 : 6

7100 at 8d.

*Facit* £ 236 : 13 : 4

6100 at 8¼d.

*Facit* £ 209 : 13 : 9

8000 at 8½d.

*Facit* £ 283 : 6 : 8

6000 at 8¾d.

*Facit* £ 218 : 15

9000 at 9d.

*Facit* £ 337 : 10

4121 at 9¼d.

*Facit* £ 158 : 16 : 7¼

6100 at 9½d.

*Facit* £ 241 : 9 : 2

5918 at 9¾d.

*Facit* £ 240 : 8 : 4½

8121 at 10d. *

*Facit* £ 338 : 7 : 6

6712 at 10¼d.

*Facit* £ 286 : 13 : 2

1002 at 10½d.

*Facit* £ 43 : 16 : 9

4680 at 10¾d.

*Facit* £ 209 : 12 : 6

1260 at 11d.

*Facit* £ 57 : 15

6121 at 11¼d.

*Facit* £ 286 : 18 : 5¼

1234 at 11½d.

*Facit* £ 59 : 2 : 7

2345 at 11¾d

*Facit* £ 114 : 16 : 1¼

100 at 11¾d.

*Facit* £ 4 : 17 : 11

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* *Note*, When the price of an integer is 10d annex a cypher to the given number, and divide by 12 and by 20.

### CASE III.

Q. What muſt be done with the price of an Integer, when it is greater than a ſhilling, but leſs than two ſhillings?

A. Let the part or parts be taken only with ſo much of the given price as is more than one ſhilling; that is, if the price be 14½d. take the parts only with 2½d. and let the given quantity ſtand for ſhillings which muſt be added with the reſt; and the total will be the anſwer in ſhillings.

### EXAMPLES.

¼ | ¼ | 486 at 12¼d.
12 | 121 ½

10 : 1½

2|0 | 49|6 : 1½

£ 24 : 16 : 1½

½ | ½ | 486 at 12½d.
12 | 243
20 : 3
2|0 | 50|6 : 3
£ 25 : 6 : 3

7612 at 12¼d

*Facit* £ 388 : 10 : 7

1216 at 12½d.

*Facit* £ 63 : 6 : 8

1216 at 12¾d.

*Facit* £ 64 : 12

6121 at 13d.

*Facit* £ 331 : 11 : 1

1281 at 13¼d.

*Facit* £ 70 : 14 : 5¼

6100 at 13½d.

*Facit* £ 343 : 2 : 6

1210 at 13¾d.

*Facit* £ 69 : 6 : 5½

1210 at 14d.

*Facit* £ 70 : 11 : 8

1271 at 14¼d.

*Facit* £ 75 : 9 : 3¾

6120 at 14½d.

*Facit* £ 369 : 15

1210 at 14¾d.

*Facit* £ 74 : 7 : 3½

1260 at 15d.

*Facit* £ 78 : 15

1612 at 15¼d.

*Facit* L 102 : 8 : 7

1210 at 15½d.

*Facit* L78 : 2 : 11

7612 at 15¾d.

*Facit* L499 : 10 : 9

6100 at 16d.

*Facit* L406 : 13 : 4

7121 at 16¼d.

*Facit* L 482 : 3 : 0¼d.

1218 at 16½d.

*Facit* L 83 : 14 : 9

8100 at 16¾d·

*Facit* L 565 : 6 : 3

4128 at 17d.

*Facit* L 292 : 8

1230 at 17¼d.

*Facit* 88 : 8 : 1½d.

2340 at 17½d.

*Facit* L 170 : 12 : 6

3450 at 17¾d.

*Facit* L 255 : 3 : 1½

4560 at 18d.

*Facit* £342

5670 at 18¼d.

*Facit* £431 : 3 : 1½

6789 at 18½d.

*Facit* £523 : 6 . 4½

7890 at 18¾d.

*Facit* £616 : 8 : 1½.

8900 at 19d.

*Facit* £704 : 11 : 8

9000 at 19¼d.

*Facit* £721 : 17 : 6

9876 at 19½d.

*Facit* £802 : 8 : 6

8765 at 19¾d,

*Facit* £ 721 : 5 : 8¾

7120 at 20¼d,

*Facit* £ 600 : 15

6543 at 20½d.

*Facit* £558 : 17 : 7½

5432 at 20¾d.

*Facit* £469 : 12 : 10

4321 at 21d.

*Facit* £ 378 : 1 : 9

3210 at 21¼d.

*Facit* £ 284 : 4 : 4½

2100 at 21½d.

*Facit* £ 188 : 2 : 6

1000 at 21¾d.

*Facit* £ 90 : 12 : 6

1090 at 22d †

*Facit* £ 99 : 18 : 4

9010 at 22¼d.

*Facit* £ 835 : 6 : 0½

6700 at 22½d.

*Facit* £ 628 : 2 : 6

6812 at 22¾d.

*Facit* £ 645 : 14 : 5

1210 at 23d.

*Facit* £ 115 : 19 : 2

1800 at 23¼d.

*Facit* £ 174 : 7 : 6

6760 at 23½d.

*Facit* £ 661 : 18 : 4

9990 at 23¾d.

*Facit* £ 988 : 11 : 10½

† Note, When the price of an integer is 22d. annex a Cypher to the given number, and divide by 12 (as at 10d.) then add both lines together, the ſum will be the total in ſhillings.

## CASE IV.

Q. What muſt be done with the price of an Integer, when it is any even number of ſhillings under 20s, as 6s. 8s. &c.

A. Multiply the given quantity by half of the price, and double the firſt figure of the product of ſhillings, and the reſt of the product will be pounds.

Note, This rule is taken from an operation in Decimals.

### EXAMPLES.

486 at 2s.
1

£48 : 12s.

769 at 4s.
2

£153 : 16s.

7612 at 2s.

*Facit* £761 : 4s.

1286 at 4s.

*Facit* £257 : 4s.

7618 at 6s.

*Facit* L 2285 : 8s.

191 at 8s.

*Facit* L 76 : 8s.

180 at 10s. *

*Facit* L 90

171 at 14s.

*Facit* L 119 : 14s.

171 at 16s.

*Facit* L 136 : 16s.

712 at 18s.

*Facit* L 640 : 16s.

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* Note, When the price of an Integer is 10s. you may take half of the given Integers, and it is done; and the remainder (if there be any) will be 10s.

## CASE V.

Q. What muſt be done with the price of an Integer, when it is any odd number of ſhillings under 20 as 3s. 5s. &c.

A. Multiply the given Integers by the prices, and that product divide by 20, the quotient will be the anſwer.

### EXAMPLES.

121 at 1s.

*Facit* £ 6 : 1s.

121 at 3s.

*Facit* £ 18 : 3s.

471 at 5s. †

*Facit* £ 117 : 15s

860 at 7s.

*Facit* £ 301

612 at 9s.

*Facit* £ 275 : 8s.

121 at 11s.

*Facit* £ 66 : 11s.

600 at 13s.

*Facit* £ 390

190 at 15s.

*Facit* £ 142 : 10s.

121 at 17s.

*Facit* £ 102 : 17s.

100 at 19s.

*Facit* £ 95.

---

† Note, When the price of an Integer is 5s. the work may be done at once, becauſe 5s. is the fourth part of a pound.

## CASE VI.

Q. What muſt be done with the price of an Integer, when it is ſhillings and pence?

A. 1. If the ſhillings and pence be the aliquot part of a pound, it may be done at once, as 6s. 8d. is the third of a pound.

Examples.

12 at 6s. 8d.

*Facit* £4

69 at 3s 4d.

*Facit* £11 : 10

21 at 2s. 6d.

*Facit* £2 : 12 : 6

96 at 1s. 8d.

*Facit* £ 8

2. If the ſhillings and pence be not the aliquot part of a pound, or if there be ſhillings, pence and farthings, multiply the given quantity by the ſhillings, and take parts with the reſt, and add them together; the ſum will be the anſwer in ſhillings.

Examples.

3 | ¼ | 126 at 9s. 3d.
9
1134
31 : 6
2|0 116|5 : 6
£58 : 5 : 6

86 at 6s. 10d.

*Facit* £29 : 7 : 8

10 at 12s. 4d.

*Facit* £6 : 3 : 4

30 at 4s. 9d.

*Facit* £7 : 2 : 6

73 at 7s. 6d.

*Facit* £27 : 7 : 6

70 at 7s. 4¾d.

*Facit* £25 : 17 : 8½

55 at 4s. 8½d.

*Facit* £ 12 : 18 : 11½

77 at 10s. 6¼

*Facit* £40 : 10 : 1¼

12 at 13s. 10½d.

*Facit* L8 : 6 : 6

17 at 17s. 4¼d.

Facit L14 : 15 : 0¾d

46 at 7s. 3¾d.

Facit L16 : 16 : 4½

## CASE VII.

Q. What muſt be done with the price of an Integer, when it is pounds only?

A. Multiply the given Integers by the price, the product will be the anſwer.

Examples.

72 at 5l.

*Facit* £360

---

64 at 3l.

*Facit* £192

---

19 at 4l.

*Facit* £76

---

46 at 7l.

*Facit* £322

## CASE VIII.

Q. What muſt be done with the price of an Integer, when it is pounds and ſhillings?

A. Multiply the integer given, by the pounds; then proceed with the ſhillings if they are even, according to Caſe IV. but if they are odd, according to Caſe V. and add them together: the total will be the anſwer.

Examples.

26 at 4l. 8s.
4
104
10 : 8
£114 : 8

---

49 at 3l. 7s.
7
2|0 34|3
17 : 3
147
£164 : 3

---

36 at 5l. 13s.

*Facit* £ 203 : 8s.

---

48 at 7l. 10s.

*Facit* £360

---

26 at 11l. 14s.

*Facit* £304 : 4s.

---

15 at 4l. 13s.

*Facit* £69 : 15s.

---

17 at 9l. 15s.

*Facit* £165 : 15s.

---

16 at 3l. 6s.

*Facit* £52 : 16s.

### CASE IX.

Q. What muſt be done with the price of an integer, when it is pounds, ſhillings and pence?

A. 1. If the ſhillings and pence be the aliquot part of a pound, multiply the given integers by the pounds, and divide by the aliquot part: Thoſe numbers ſo found out, being added together, will be the ſum required.

*Examples.*

47 at 3l. 3s. 4d.

*Facit* £ 148 : 16 : 8

20 at 4l. 13s. 4d.

*Facit* £ 93 : 6 : 8

17 at 2l. 6s. 8d.

*Facit* £ 39 : 13 : 4

30 at 1l. 2s. 6d.

*Facit* £ 33 : 15s.

2. If the ſhillings and pence be not the aliquot part of a pound, or if there be ſhillings, pence, and farthings, given with the pounds, then reduce the pounds and ſhillings, into ſhillings, and multiply the given integers by the ſaid ſhillings; next take parts with the reſt of the price, and add them together as before.

*Examples.*

```
3 | 1/4 | 120 at 4l. 7s. 3½d.
    |     |      87       20
    |     | ---------    ----
    |     | 10440       87
1/2 | 1/6 |    30
    |     |     5
    |     ---------------
  2|0 1047|5
      £523 : 15s.
```

14 at 2l. 10s. 6d.

*Facit* £ 35 : 7s.

21 at 5l. 14s. 7¼d.

*Facit* £120 : 6 : 8¼

70 at 1l. 14s. 7d.

*Facit* £121 : 0 : 10

46 at 3l. 19s. 8½d.

*Facit* £183 : 6 : 7

Q. What other way have you of anſwering queſtions in this caſe?

A. 1. When the number of integers does not exceed 12, multiply the price by the Integers, as in Compound Multiplication, the product will be the anſwer.

2. When the number of integers does exceed 12, multiply the price by the parts inſtead of the whole. Or,

3. You may multiply the price by the whole number for integers. Thus,

58361 hhds. of tobacco, at 48l. 12s. 9d. per hhd.

| *l* | *s.* | *d.* |
|---|---|---|
| 48 | 12 | 9 |
| 58361 | | |
| 48 | 12 | 9 |
| 2918 | 5 | 0 |
| 14591 | 5 | 0 |
| 389100 | 0 | 0 |
| 2431875 | 0 | 0 |
| 2838533 | 2 | 9 |

Memorandum.

| 1. | | 2. | | 3. | | 4. | |
|---|---|---|---|---|---|---|---|
| *s.* | *d.* | *s.* | *d* | *s.* | *d.* | *s.* | *d.* |
| 16 | 6 | | | | | | |
| 18 | 3 | 2 | 6 | | | | |
| 2 | 0 | | | | | | |
| 3 | 9 | 17 | 6 | 15 | 0 | 10 | 0 |

Q. How is it wrought?

A. Multiply by the ſeveral figures in the multiplier as in Compound Multiplication, but with this difference, that the product of the ſhillings and pence, Multiplied by the 6, 3, 8, and 5, muſt be placed by themſelves in a Memorandum, and the product of the pounds by the ſame figures, placed as in Simple Multiplication. Thus,

| | *l.* | *s.* | *d.* | Memor. *s.* | *d.* |
|---|---|---|---|---|---|
| | 48 | 12 | 9 | | |
| | 58361 | | | | |
| 1 Product | 48 : | 12 : | 9 | | |
| 2 | 291 | | | 16 | 6 |
| 3 | 145 | | | 18 | 3 |
| 4 | 389 | | | 2 | 0 |
| 5 | 243 | | | 3 | 9 |

Then to fill up the blanks in the ſecond product, take half of the 16s. in the memorandum, which is 8, and ſet it in the unit's place of the pounds. Annex a cypher to the 6d. which makes 60d. or the 5s. place this under the ſhillings, and the line is done with, there being no price remaining.

For the blanks in the third product, take half of the 18s. in the memorandum, and put it in the ten's place of the pounds. Annex a cypher to the 3d, which makes it 30d. or 2s. 6d. this put in the ſecond memorandum. Then take half of the 2s. in this new memorandum, and put it in the unit's place of the pounds. Annex a cypher to the 6d. in the new memorandum, which makes 60d. or 5s. put this in the place of ſhillings, and the line is finiſhed, there being no pence remaining.

For the blanks in the fourth product, take half of the 2s. in the firſt memorandum, and put it into the hundred's place of the pounds; and becauſe there remains nothing, nor are there any pence in the memorandum, therefore fill up the other blanks with cyphers and the line is finiſhed.

For the blanks in the fifth product, take half of the 3s. in the firſt memorandum, and put it in the thouſand's place of the pounds; then becauſe there is one remaining, put that in the ſecond memorandum Annex a cypher to the 9d. which makes 90d. or 7s. 6d. put this to the former 1, and it makes 17s. 6d. take half the 17s. and put in the hundred's place of the pounds; then, becauſe there is one remaining, put that in the third memorandum. Annex a cypher to the 6d. and it makes 60d. or 5s. put this to the 1 in the third memorandum, and it makes 15s. take half of the 15s. and put it in the tens place of the pounds; then becauſe there remains 1, put it in the fourth memorandum, and ſince there are no pence in the third memorandum, to put a cypher to, let a cypher be annexed to the 1 in the laſt memorandum, which makes 10s. take half of this 10s. and put it in the unit's place of the pounds; then, becauſe there are no pence in the memorandum, neither is there any thing remaining of the 10, therefore fill up the other blanks with cyphers, and the line is completed; Add all together, and their ſum is the total product of the whole.

| | *l.* | *s.* | *d.* | | *Memorandum.* | | |
|---|---|---|---|---|---|---|---|
| | | | | | 1. | 2. | 3. |
| 7000 hhds. of wine at | 17 | 14 | 8 | per hhd. | *s. d.* | *s. d.* | *s. d.* |
| | | | 7000 | | | | |
| | 124133 | 6 | 8 | | 2 8 | 6 8 | 6 8 |

Note, 1. To fill up the blanks in the pounds of the ſecond, third, &c. pounds, always take half of the ſhillings in the memorandum; and if 1 remains make a new memorandum of it.

2. Always annex a cypher to the pence, and whatever number of ſhillings they make, put them to the 1 in the new memorandum; and ſo on till all the blanks in the pounds are filled up: If there be any pence yet remaining in the memorandum, put a cypher to them, and what ſhillings and pence they make, let them be put in the ſhillings and pence place in the product.

3. All the examples in this caſe, and caſe 8, may ſerve here, inſtead of others.

## CASE X.

Q. What muſt be done with the price of an integer, when both that and the quantity given are of ſeveral denominations?

A. Multiply the price by the integers, and take parts with the parts of integers.

### EXAMPLES.

| C. | qrs. | lb. | | l. | s. | | | l. | s. | d. |
|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 3 | 16 | of tobacco, at | 4 | 12 | per cwt. | *Facit* | 59 | 6 | $1\frac{1}{2}$+ |

| | | | | |
|---|---|---|---|---|
| $\frac{1}{2}$ | $\frac{1}{2}$ | 12 | | |
| | | 55 | 4 | |
| $\frac{1}{4}$ | $\frac{1}{2}$ | 2 | 6 | |
| 16 | $\frac{1}{7}$ | 1 | 3 | |
| | | 0 | 13 | $1\frac{1}{2}$+ |
| | | £59 | 6 | $1\frac{1}{2}$+ |

| C. | qrs. | lb. | | | l. | s. | d. | | | l. | s. | d. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 2 | 14 | of tobacco, | at | 3 | 14 | 0 | *per* cwt. | *Facit* | 46 | 14 | 3 |
| 17 | 3 | 19 | of ſugar, | at | 2 | 2 | 6 | *per* cwt. | *Facit* | 80 | 1 | $6\frac{1}{4}$ |
| 4 | 1 | 16 | of ſoap, | at | 3 | 12 | 0 | *per* cwt. | *Facit* | 15 | 16 | $3\frac{1}{4}$ |
| 10 | 0 | 12 | of tallow, | at | 1 | 19 | 6 | *per* cwt. | *Facit* | 19 | 19 | $2\frac{1}{2}$ |
| 5 | 1 | 0 | of tobacco, | at | 2 | 17 | 0 | *per* cwt. | *Facit* | 14 | 19 | 3 |
| 4 | 3 | 0 | of ſugar, | at | 2 | 18 | 6 | *per* cwt. | *Facit* | 13 | 17 | $10\frac{1}{2}$ |
| 7 | 0 | 19 | of ſugar, | at | 3 | 16 | 0 | *per* cwt. | *Facit* | 27 | 4 | $10\frac{1}{2}$ |
| 5 | 2 | 10 | of tobacco, | at | 2 | 18 | $6\frac{1}{2}$ | *per* cwt. | *Facit* | 16 | 27 | $2\frac{1}{2}$ |
| 7 | 1 | 14 | of tobacco, | at | 3 | 15 | $9\frac{1}{4}$ | *per* cwt. | *Facit* | 27 | 18 | $9\frac{1}{2}$ |
| 19 | 2 | 26 | of tallow, | at | 4 | 10 | $4\frac{1}{2}$ | *per* cwt. | *Facit* | 43 | 19 | 6 |

## OF INTEREST.

Q. HOW many kinds of Intereſt are there?

A. Two: Simple and Compound.

### *Of Simple Interest.*

Q. What is Simple Intereſt?

A. Simple Intereſt is the profit allowed in the lending or forbearance of any ſum of money for ſome determined ſpace of time.

Q. What is the principal?

A. The principal is any ſum of money lent, for which intereſt is to be received.

Q. What is the rate *per cent*?

A. It is a certain ſum agreed on between the lender and the borrower, to be paid for every 100 pounds for the uſe of the principal, which, according to the laws of England, ought not to be above 5l. for the uſe of 100l. for one year, and 10l. for the uſe of 100l. for two years; and ſo on for any ſum of money, in proportion to the time propoſed.

Q. What is the amount ?

A. It is the principal and intereſt added together.

Q. What other things are intereſt applicable to ?

A. It is applied to commiſſion or proviſion, brokage, ſtorage, and inſurance, which have no reſpect to time.

## CASE I.

Q. How do you find the intereſt of any given ſum for a year ?

A. Multiply the principal by the rate *per cent.* and divide that product by 100, the quotient is the intereſt required.

Q. How do you find the intereſt of any given ſum for ſeveral years ?

A. Multiply the intereſt for one year by the number of years given in the queſtion ; the product will be the anſwer.

Examples.

1. If 100l. in one year's time yield 5l. intereſt—what will 486l. yield in the ſame time? *Anſ.* £ 24 : 6

```
   £486
      5
   ----
   24|30
     |20
     |--
    6|00
```

2. What is the intereſt of 220l. for a year at 4 *per cent. per ann ?* *Anſ.* £8 : 16.

3. What is the intereſt of 76l. for two years, at 5 *per cent. per ann ?* *Anſ.* 7 : 12.

4. What is the amount of 400l. for 12 years, at 6 *per cent. per ann ?* *Anſ.* £688.

### *Of factor's Allowances, commonly called Commiſſion or Proviſion.*

Q. What is Commiſſion or Proviſion ?

A. It is an allowance from merchants to their factors or agents beyond the ſeas, in the buying or ſelling of any ſort of goods ; and it is a certain rate *per cent.* according to the cuſtom of the country where the factor reſides.

Examples.

5. My factor ſends me word, that he has bought goods to the value of 500l. 13s. 6d. upon my account ; I demand what his commiſſion comes to, at $3\frac{1}{2}$ *per cent.*

*Anſ.* £ 17 : 10 : 5 : $2\frac{68}{100}$*qrs.*

6. My correſpondent has diſburſed upon my account, the ſum of 1009l. 18s what muſt he demand for his commiſſion, when I allow him $2\frac{1}{4}$ *per cent* ?

*Anſ.* £ 22 : 14 : 5 : $1\frac{84}{100}$*qr.*

7 Suppoſe I allow my correſpondent $1\frac{3}{4}$ *per cent.* for proviſion; what may he demand on the diſburſement of 704l. 15s. 4d? *Anſ.* £ 12 : 6 : $8\frac{2}{100}$*d.*

## CASE II.

Q How do you find the intereſt of any ſum for $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, of a year, beſides the number of years given in the queſtion?

A For $\frac{1}{4}$ of a year, take a fourth part of the intereſt for one year; for $\frac{1}{2}$ a year take half of the intereſt for one year; for $\frac{3}{4}$ of a year, take the parts compounded of $\frac{3}{4}$ and add them to the intereſt for the reſt of the time; the ſum will be the intereſt required.

### Examples.

1. What is the intereſt of 200l. for 3 years and $\frac{3}{4}$ at 5 *per cent. per ann* ? *Anſ.* £ 37 : 10*s.*

```
  200          | 1/2 | 1/2 | 10
    5          |     |     |  3
 ----          |     |     | --
10|00          |     |     | 30
               | 1/4 | 1/2 |  5
               |     |     |  2  10
                             -----
                            £37  10s.
```

2. What is the intereſt of 468l. 12s. 4d. for $1\frac{3}{4}$ year, at 6 *per cent. per ann* ? *Anſ.* £49 : 4 : 1.

3. What is the intereſt of 1 12l. 10s. 4d. for $5\frac{1}{2}$ years at 6 *per cent. per ann* ? *Anſ* £37 : 2 : 7d+

4. What is the intereſt of 468l. for $4\frac{1}{4}$ years, at 6 *per cent. per ann* ? *Anſ.* £119 : 6 : $8\frac{3}{4}$.

5. What is the intereſt of 1000l. for $2\frac{3}{4}$ years, at 4 *per cent. per ann* ? *Anſ.* £ 110.

## *Of Brokage.*

Q. What is brokage?

A. It is an allowance made to perſons called brokers, at a certain rate *per cent* for finding cuſtomers, and ſelling to them the goods of other men, whether ſtrangers or natives.

Q. How do you find the brokage of any ſum?

A. Divide the given ſum by 100, and take parts from the quotient with the rate *per cent.*

### Examples.

6. What is the brokage of 700l. 14s. 6d. at 4s. *per cent?*
*Anſ.* £ 1 : 8 : 0¼.

```
 l.  s.  d.                 l.   s.   d.
7|00 14  6        | 4 | 1/5 | 7    0    1½
 |20                        |----------------
 |—                         | 1    8    0¼
0|14
 |12
 |—
1|74
 | 4
 |—
2|96
```

7. What may a broker demand for brokage, when he ſells goods to the value of 500l. 10s. 7d. and I allow him 7s. *per cent?* *Anſ.* £1 : 15 : 0¼.

8. Suppoſe I employ a broker, who ſells goods to the value of 909l. 14s. 10d. what is the brokage at 6s. 6d. *per cent.?* *Anſ.* £2 : 19 : 1¼.

Note, If the brokage ſhould be 1l. or more per cent. the operation will be the ſame with that in Factor's Allowances.

## CASE III

Q. How is the intereſt of any ſum found when the rate *per cent.* is ¼, ½, or ¾ more than the pounds given in the ſaid rate?

A. Multiply the principal by the pounds in the rate *per cent.* as before; and let the parts for ¼, ½, or ¾, be taken from the principal, and added to that product, then proceed according to Caſe 1 or 2.

### Examples.

1. What is the intereſt of 400l. for 2 years, at 5½ *per cent. per ann?* *Anſ.* £44.

2. What is the intereſt of 120l. for a year, at 4½ *per cent. per ann?* *Anſ.* £5 : 8*s.*

3. What is the amount of 690l. for 3 years, at 4¼ *per cent. per ann?* *Anſ.* £777 : 19 : 6

4. What is the amount of 120l 10s. for 2 years and an half, at 4¾ *per cent. per ann?* *Anſ.* £ 134 : 16 : 6¾

5. What is the intereſt of 300l. for 5 years and 3 quarters at 3¾ *per cent. per ann?* *Anſ.* £64 : 13 : 9.

## CASE IV.

*Q.* How do you find the intereſt of any ſum for a certain number of weeks?

A. As 52 weeks
Are to the intereſt of the given ſum for a year:
So are the weeks given,
To the intereſt required.

Examples.

1. What is the intereſt of 400l. for a week, at 5 *per cent. per ann*? *Anſ.* 7s. 8d. $1\frac{12}{52}$*qr.*

2. What is the intereſt of 126l. 12s. for 16 weeks, at $4\frac{1}{2}$ *per cent. per ann*? *Anſ.* £1 : 15 : 0 : $2\frac{40}{52}$*qrs.*

3. What is the amount of 500l. for 20 weeks at $3\frac{1}{2}$ *per cent. per ann*? *Anſ* £506 : 14 : 7 : $1\frac{28}{52}$*qr.*

## CASE V.

*Q.* How is the principal found, when the amount, time, and rate per cent. are given?

A. As the amount of 100l. at the rate and time given
Is to 100l.
So is the amount given,
To the principal required.

Examples.

1. What principal being put to intereſt for 9 years at 5 *per cent. per ann.* will amount to 725l? *Anſ.* L500.

2. What principal being put to intereſt for 7 years, will amount to 793l. 12s. at 4 *per cent. per ann*? *Anſ.* L620.

3. What ſum being put to intereſt, will amount to 520l. 16s. in 8 years, at 3 *per cent. per ann*? *Anſ.* L420.

## CASE VI.

Q. How is the rate *per cent.* found, when the amount, time and principal are given?

A. 1. As the principal,
Is to the intereſt for the whole time
So is 100l.
To its intereſt for the ſame time.

2. Divide the intereſt laſt found by the time, and the quotient will be the rate *per cent.*

Examples.

1. At what rate of intereſt *per cent.* will 500l. amount to 725l. in 9 years time? *An.* L5 *per cent.*

2. At what rate of intereſt *per cent.* will 620l. amount to 793l. 12s. in 7 years? *An.* 4 *per cent.*

3 At what rate of intereſt *per cent.* will 420l. amount to 520l. 16s. in 8 years? *Anſ.* 3 *per cent.*

### Caſe VII.

Q. How is the time found, when the principal amount, and rate *per cent.* are given?

A. As the intereſt of the principal for 1 year at the given rate
Is to one year:
So is the whole intereſt,
To the time required,

*Examples.*

1. In what time will 500l. amount to 725*l*, at 5 *per cent. per ann*? *Anſ.* 9 *years.*

2. In what time will 620l. amount to 793l. 12s. at 4 *per cent. per ann*? *Anſ.* 7 *years.*

3. In what time will 420l. amount to 520l, 16s. at 3 *per cent. per ann*? *Anſ.* 8 *years.*

Q. How are the queſtions in the foregoing caſes proved?

A. Caſes 1. 5, 6, and 7, do exactly prove each other, by varying the queſtions; Yet all of them, except Caſe V. and the 1ſt, 2d, 5th, 6th, and 7th queſtions in Caſe I.; and the 6th, 7th and 8th, in Caſe II. may as truly be anſwered by the Double Rule of Three, of which more hereafter.

Note 1, The 1ſt, 2d, 5th, 6th, and 7th queſtions in Caſe I. and the 6th 7th, and 8th. in Caſe II. are to be proved by the Single Rule of Three.

2. Caſe V cannot be anſwered by the Double Rule of Three, becauſe the principal is not known in the queſtion, and therefore there can be no deduction of it from the amount, to know the intereſt, which muſt firſt be done.

## *Of Simple Intereſt for Days.*

Q. How do you find the intereſt for any number of days?

A. Multiply the pence of the principal by the days, and by the rate of intereſt for a dividend, and 365 by 100 for a diviſor, the quotient will be the anſwer in pence.

Q. How are the following queſtions proved?

A. As 365 days
Are to the intereſt of the given ſum for a year:
So is the time propoſed,
To the intereſt required.

*Examples.*

1. What is the intereſt of 120l. for 126 days, at 4 *per cent. per ann.*? *Anſ.* £ 1 : 13 : 1 : $2\frac{228}{365}$ *qrs.*

2. What is the intereſt of 126l. for 145 days at 6 *per cent. per ann*? An. £3 : 0 : $3\frac{57}{365}$ *qrs.*

3. What is the intereſt of 100l. from June 1, 1783, to March 9, 1784, which is leap year, at 5 *per cent. per ann.*?
*Anſ. L* 3 : 17 : 6 : $1\frac{235}{365}$ *qrs.*

4. What is the intereſt of 200l. from Auguſt 14, to December 19 following, at 6 *per cent. per ann.*?
*Anſ. L*4 : 4 : 1 : $3\frac{325}{365}$ *qrs.*

5. What is the intereſt of 10l. for 25 days, at 5 *per cent. per ann.*?
*Anſ.* $8\frac{30}{365}$*d*

6. What is the intereſt of 40l. for 40 days, at 4 *per cent. per ann.*?
*Anſ.* 3*s.* 6*d.* $\frac{30}{365}$*d.*

Note, See more of Simple Intereſt in Decimals.

## *Of Compound Intereſt.*

Q. What is Compound Intereſt?

A. Compound Intereſt is that which ariſes from any principal and its intereſt put together as the intereſt ſtill becomes due; and for that reaſon it is called intereſt upon intereſt, or compound intereſt.

Q. Is it lawful to let out money at compound intereſt?

A. No: Yet in purchaſing annuities or penſions, and leaſes in reverſion, it is very uſual to allow compound intereſt to the purchaſer for his ready money; and therefore it is very neceſſary for him to underſtand it.

Q. How do you find the compound intereſt of any given ſum for any number of years?

A. 1. Find the amount of the given ſum by ſimple intereſt for the firſt year, which is the principal for the ſecond year, then find the amount of that principal for the ſecond year, and that is the principal for the third year: and ſo on for any number of years given.

2. Subtract the given ſum from the laſt amount, and the remainder is the compound intereſt required.

### EXAMPLES.

1. What ſum will 450l. amount to in 3 years, at 5 *per cent. per ann.* compound intereſt? *Anſ.* £520 : 18 : 7½d.

2. What will 400l. amount to in 4 years, at 6 *per cent. per ann.* compound intereſt? *An.* £504 : 19 : 9¾.

3. What will 480l. amount to in 6 years at 5 *per cent. per ann.* compound intereſt? *An.* £643 : 4 : 10½.

4. What will 500l. amount to in 4 years, at 4¼ *er cent. per ann.* compound intereſt? *An.* £590 : 11 : 5½.

5. What is the compound intereſt of 400l. 10s. at 3½ *per cent. per ann.* for 3 years? *An.* £43 : 10 : 9½.

*Note*, See more of Compound Intereſt in Decimals.

## OF REBATE OR DISCOUNT.

Q. WHAT is Rebate or diſcount ?

A. Rebate or Diſcount is when a ſum of money due at any time to come, is ſatisfied by paying ſo much preſent money as being put out to intereſt, would amount to the given ſum in the ſame ſpace of time.

Q. How is the operation performed ?

A. 1. As 12 months :
Are to the rate *per cent.* : :
So is the time propoſed :
To a fourth number.
2. Add that fourth number to 100l.
3. As that ſum :
Is to the fourth number :
So is the given ſum :
To the rebate.
4. Subtract the rebate from the given ſum, and the remainder is the preſent worth, or thus,
5. As that ſum :
Is to 100l. ::
So is the given ſum :
To the preſent payment.
6. Subtract the preſent payment from the given ſum, and the remainder is the rebate.

Q. How do you prove queſtions in rebate ?

A. Find the amount of the preſent payment at the time and rate *per cent* given, and that will be equal to the given ſum.

### EXAMPLES.

1. What is the rebate of 795l. 11s. 2d. for 11 months, at 6 *per cent ?* *Anſ.* £41 : 9 : 5 : $3\frac{1572}{2532}$ *qrs.*

2. What is the preſent worth of 161l. 10s. for 19 months, at 5 *per cent.* ? *Anſ.* £149 : 13 : $0\frac{3}{4}$

3. Sold goods for 795l. 11s. 2d. to be paid 4 months hence,—what is the preſent worth, at $3\frac{1}{2}$ *per cent ?* *Anſ.* £786 : 7 : $8\frac{1}{4}$.

4. What is the preſent worth of 4000l payable in 9 months, at $4\frac{3}{4}$ *per cent ?* *Anſ.* £3862 : 8 : $0\frac{1}{2}$.

5. How much ready money for a note of 18l. due 15 months hence, at 5 *per cent.* ? *Anſ.* £16 : 18 : 10.

6. Suppoſe 810l. were to be paid 3 months hence, allowing 5 *per cent.* diſcount,—what muſt be paid in hand? *Anſ.* £800

7. If a legacy of 1000l. is left me July 24, 1786, to be paid on the Chriſtmas-day following;—what muſt I receive, when I allow 6 *per cent.* for preſent payment? *Anſ.* £975 : 3 : 1.

8. Being obliged by a bond, bearing date Auguſt 29, 1791, to pay next Midſummer (which is leap year) 326l. —what muſt I pay down if they allow diſcount after the rate of 8 *per cent.*? *Anſ.* £305 : 16 : 6¼.

9. Sold goods for 312l. to be paid at two three months, (that is, half at 3 months, and the other half at 3 months after that)—what muſt be diſcounted for the preſent payment, at 5 *per cent.*? *Anſ.* £5 : 14 : 7.

10. Sold goods for 300l to be paid at three two months, (that is, one third at 2 months, one third at 4 months, and one third at 6 months)—what muſt be diſcounted for preſent payment at 4 *per cent*? *Anſ.* £3 : 18 : 9.

11. What is the preſent worth of 100l. at 5 *per cent.* payable at two four months? *Anſ.* £97 : 11 : 4½.

12. I would know the preſent worth of 150l. payable at three four months at 5 *per cent* diſcount? *Anſ.* £145 : 3 : ½.

13. What is the preſent worth of 200l. at 4 *per cent.* payable as follows, viz. 100l. at two months; 50l at 3 months, and 50l. at 5 months? *Anſ* £198 : 0 : 6.

## OF EQUATION OF PAYMENTS.

### *The common Way.*

Q. WHAT is Equation of Payments?

A. When ſeveral ſums of money, to be paid at different times are reduced to one mean time for the payment of the whole, without loſs to debtor or creditor, this is called equation of payments.

Q. Wherein may the debtor or creditor be ſaid to ſuffer loſs, when the debt is paid.

*A.* 1. When one mean time is aſſigned for the payment of the whole debt, and the money is not paid till ſome time afterwards; then the debtor ſuffers loſs by lying not only out of the principal, or ſum due, but alſo the intereſt of that ſum for the time of forbearance, at 3, 4, or more *per cent.* as they ſhall agree. Likewiſe, if the money be paid before it is due, then the creditor ſuffers loſs by allowing ſo much *per cent* by agreement, for the time of prompt payment.

2. The loſs to either party may be in reducing the ſeveral times of payment to one, which is not the true equated time: and then if the payment be made after the true time, the creditor ſuffers loſs, becauſe he receives no intereſt for it: If the time agreed on be before the true time, then the debtor ſuffers loſs, becauſe he receives no intereſt for his early payment.

Q. How is the operation wrought?

A. Multiply each payment by its time, and divide the ſum of all the products by the whole debt, the quotient is the equated time.

EXAMPLES.

1. A owes B 100l. whereof 50l is to be paid at 2 months, and 50l. at 4 months; but they agree to reduce them to one payment; when muſt the whole be paid? *Anſ.* 3 *months.*

2. A merchant hath owing him 300l. to be paid as follows, 50l. at two months, 100l. at 5 months, and the reſt at 8 months; and it is agreed to make one payment of the whole; —I demand when that time muſt be? *Anſ.* 6 *months.*

3. F owes to H 1000l. whereof 200l. is to be paid preſent, 400l. at 5 months, and the reſt at 10 months, but they agree to make one payment of the whole;—I demand the equated time? *Anſ* $6\frac{1}{5}$ *months.*

4. K is indebted to L a certain ſum, which is to be diſcharged at four ſeveral payments, that is $\frac{1}{4}$ at 2 months, $\frac{1}{4}$ at 4 months, $\frac{1}{4}$ at 6 months, and $\frac{1}{4}$ at 8 months; but they agreeing to make one payment of the whole, the equated time is therefore demanded? *Anſ.* 5 *months.*

5. H bought of X a quantity of goods upon truſt, for which H was to pay $\frac{1}{3}$ of the debt every 3 months, till the whole ſhould be diſcharged; but they afterwards agreed to pay the whole at one equated time, the time is demanded? *Anſ.* 6 *months.*

6. W owes Z a ſum of money, which is to be paid $\frac{1}{2}$ preſent, $\frac{1}{4}$ at 4 months, and the reſt at 8 months,—what is the equated time for the whole? *Anſ.* 3 *months.*

7. P owes Q. 420l. which will be due 6 months hence; but P is willing to pay him 60l. now, provided he can have the reſt forborn a longer time; It is agreed on; the time of forbearance therefore is required? *Anſ.* 7 *months.*

Note, This queſtion is in reverſe proportion. See more of this Rule in Decimals.

## OF BARTER.

*Q.* WHAT is Barter?

A. Barter is the exchanging of one commodity for another, and informs merchants ſo to proportion their quantities, as that neither may ſuſtain loſs.

*Q.* How do you prove queſtions in Barter?

A. By changing the order of them.

Examples.

1. How much ſugar at 9d. *per* lb. muſt be given in barter for 6$\frac{1}{2}$ cwt. of tobacco, at 14d. *per* lb? *Anſ.* 10 *cwt.* 12$\frac{4}{9}$*lb.*

2. What quantity of tea, at 10s. *per* lb. muſt be given in barter for 1 cwt. of chocolate, at 4s *per* lb?

*Anſ.* 44 *lb.* 12$\frac{8}{10}$ *oz.*

3. How much rice at 28s. *per* cwt. muſt be bartered for 3$\frac{1}{2}$ cwt. of raiſins, at 5d. *per* lb? *Anſ.* 5 *cwt.* 3 *qrs.* 9$\frac{112}{336}$*lb.*

4. A and B bartered: A had 5 cwt. of ſugar, at 6d. *per* lb. which he gave to B for a quantity of cinnamon, at 10s. 8d. *per* lb—I demand how much cinnamon B gave A?

*Anſ.* 26 *lb.* 4 *oz.*

5. B delivered 3 hhds of brandy, at 6s. 8d. *per* gallon, to C for 126 yards of cloth:—what was the cloth *per* yard?

*An.* 10*s.*

6. A and B bartered: A had 12 cwt. of ſugar, worth 4d. *per* lb. for which B gave him 1$\frac{3}{4}$ cwt. of cinnamon;—I demand how B rated his cinnamon *per* lb? *An.* 27*d.* 1$\frac{140}{196}$*qrs.*

7. A hath linen cloth worth 20d. an ell ready money; but in barter he will have 2s. B hath broad cloth worth 14s. 6d. *per* yard ready money,—at what price ought the broad cloth to be rated in barter? *An.* 17*s.* 4*d.* 3$\frac{4}{20}$*qrs. per yard.*

8. A and B bartered: A had 41 cwt. of hops, at 30s. *per* cwt. for which B gave him 20l. in money, and the reſt in prunes, at 5d. *per* lb—I demand how many prunes B gave A, beſides the 20l? *An.* 17 *cwt.* 3 *qrs.* 4 *lb.*

9. C hath candles, at 6s. *per* dozen ready money; but in barter he will have 6s. 6d. *per* dozen; D hath cotton at 9d. *per* lb. ready money;—I demand what price the cotton muſt be at in barter; alſo how much cotton muſt be bartered for 100 dozens of candles?

*Anſ. The cotton is 9d. 3 qrs. per lb. barter, and 7 cwt. 16lb. of cotton muſt be given for* 100 *dozen of candles.*

## OF LOSS AND GAIN.

Q. WHAT is Loſs and Gain?

A. Loſs and Gain is a rule which teacheth merchants what they ſhall gain or loſe in the ſale of their goods, having the price that they bought them for, and the price for which they are to be ſold, both known.

Q. How are the following queſtions proved?

A. Let them be varied.

Examples.

1. Bought 18 cwt. of cheeſe, at 28s. *per* cwt. which I ſell out again at $3\frac{1}{2}$d. *per* lb. what is the profit of the whole? *An.* £4 : 4*s.*

2. If I buy deals at 20d. a piece, and ſell them again at 17d—what ſhall I loſe by 120 dozen? *An.* £18.

3. Hats bought at 4s. a piece, and ſold again at 4s. 9d—what is the profit in laying out 100l? *An.* £18 : 15.

4. Bought 19 fother of lead, at 14s. *per* cwt—what is gained by the whole, ſold out at 4d. *per* lb? *An.* 432 : 5*s*s

5. Bought 60 reams of paper, at 15s *per* ream— ;hat i the loſs in the whole quantity, at 4 *per cent.* *An.* £1 : 16*s*.l

6. Bought 7 tons of wine, at 17l. *per* hhd. which I ſel again at 1s. *per* pint, I demand the whole gain, and the gain *per cent.* *An* £229 : 12*s. whole gain; and* £48 : 4 : 8 1 *qr.* $\frac{420}{476}$ *the gain per cent.*

7. If I ſell 500 deals at 15d a piece, and 9l. *per cent.* loſs—what do I loſe in the whole quantity? *An.* £2 : 16 : 9.

8. Bought 3 oxen for 24l. 10s. which I ſell again for 2s. *per* ſtone—what ought the 3 oxen to weigh together, the hides and offal being the only clear gain? *An.* 245 *ſtone.*

9. A draper bought 100 yards of broad cloth, for which he gave 56l.—I deſire to know how he muſt ſell it *per* yard to gain 19l. in the whole? *An.* 15*s. per yard.*

10. A draper bought 100 yards of broad cloth for 56l—I demand how he muſt ſell it *per* yard to gain 15l. in laying out 100l.? *An.* 12*s.* 10*d.* 2 *qrs.* $\frac{24}{100}$.

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## OF FELLOWSHIP.

Q. HOW many ſorts of Fellowſhip are there?

A. Two; Single and compound.

### *Of Single Fellowſhip.*

Q. What is Single Fellowſhip?

A. Single Fellowſhip is when the ſtocks of each partner continue for an equal term of time.

Q. What is the rule?

A. As the ſum of the ſeveral ſtocks,
Is to the total gain or loſs:
So is each man's ſhare in ſtock,
To his ſhare of the gain or loſs.

Q. How is this Rule proved?

A. Add all the ſhares together, and the Sum will be equal to the given gain or loſs,

*Note*, This way of proving Fellowſhip will not hold good always: For if an error ſhould be committed in the beginning of the work and carried on through the whole operation, yet the ſame will prove, though each man's ſhare of the gain or loſs aſſigned him by that operation, be either more or leſs than his true ſhare. The moſt exact method, then that I would propoſe, though ſomething more tedious, is to change the order of the queſtion, and put each man's ſhare of the gain or loſs in the place of his ſtock firſt laid out, and make the ſum of the ſtocks ſtand in the place of the whole gain or loſs, and then it will be,

As the total gain or loſs
Is to the ſum of the ſeveral ſtocks:
So is each man's ſhare of the gain or loſs
To his particular ſhare in ſtock.

Q. What elſe doth this rule belong to beſide Fellowſhip?

A. By it the eſtate of a bankrupt may be divided among his creditors: Alſo legacies may be adjuſted, when there is a deficiency of aſſets or effects.

*Examples.*

1. A and B were ſharers in a parcel of merchandiſe, in the purchaſe of which, A laid out 3l. and B 7l. and the commodity being ſold, they find their clear gain amounts to 25s. —what part of it muſt each man have?

*An. A muſt have 7s. 6d; and B 17s. 6d.*

2. A, B, and C, trading together, gained 120l. which is to be ſhared according to each man's ſtock; A put in 140l.; B 300l.; and C 160l.;—what is each man's ſhare?

*Anſ. A 28l. B 60l. C 32l.*

3. Three merchants trading to Virginia, loſt goods to the value of 800l. Now if A's ſtock was 1200l; B's 4800l; and C's 2000l.—what ſum did each man loſe?

*Anſ. A loſt 120l.; B 480l. C 200l.*

4. Three merchants traded together, and they put into one common ſtock 1000l. each man, and gained 600l.—how much muſt each man have? *Anſ. £200 each man.*

5. Four men traded with a ſtock of 800l. and they gained in two years time twice as much and 40l. over: A's ſtock was 140l; B's 260l; C's 300l.—I demand D's ſtock; and what each man gained by trading? *Anſ. D's ſtock was 100l; and A gained 287l.; B 533l.; C 615l.; and D 205l.*

6. A, B, and C, trading to Guinea with 480l ; 680l. ; and 840l : in three year's time did gain 1010l. how much is each man's ſhare of the gain ?

*Anſ. A 242l. 8s ; B 343l. 8s. ; C 424l. 4s.*

7. D, E, and F, freighted a ſhip from the Canaries to England, with 108 tuns of wine, of which D had 48 ; E 36 ; C 24 ; but by reaſon of bad weather, they were obliged to caſt 45 tuns overboard ; how much muſt each man ſuſtain of the loſs ? *Anſ. D 20 tuns ; E 15 tuns ; F 10 tuns.*

8. A merchant is indebted to S 70l ; to T 400l ; to V 140l. 12s. 6d ; but upon his deceaſe, his eſtate is found to be worth no more than 409l. 14s. how muſt it be divided among his creditors ?

*Anſ.* { *S muſt have* £46 : 19 : 3*d.* 3 *qrs.* $\frac{141750}{146550}$
*T* - 268 : 7 : 7 1 $\frac{77250}{146550}$
*V* - 94 : 7 : 0 2 $\frac{74100}{146550}$

9. If the money and effects of a bankrupt amount to 1400l. 14s. 6d. and he is indebted to A 742l. 12s ; to B 641l. 19s. 8d ; and to C 987l. 19s. 9d. how muſt it be divided among them ?

*An.* { *A muſt have* £438 : 8 : 4*d.* 1 *qr.* $\frac{303527}{569417}$
*B* - 379 : 0 : 3 3 $\frac{158361}{569417}$
*C* - 583 : 5 : 9 3 $\frac{107529}{569147}$

## *Of Compound Fellowſhip.*

Q. What is Compound Fellowſhip ?

A. Compound Fellowſhip is when the ſtocks continue in an unequal term of time.

Q. What is the Rule ?

A. 1. Multiply each man's ſtock and time together.
2. Add the ſeveral products thence ariſing together.
3. As the ſum of thoſe products,
Is to the whole gain or loſs :
So is each product,
To its ſhare of the gain or loſs.

Q. How is this rule proved ?

A. As in Single Fellowſhip.

### EXAMPLES.

1. Three merchants traded together : R put in 120l. for 9 months ; S 100l for 16 months ; and T 100l. for 14 months ; and they gained 100l. how muſt it be divided ?

*An.* { *R muſt have* £26 : 9 : 4*d.* 3 *qrs.* $\frac{3120}{4080}$
*S* 39 : 4 : 3 3 $\frac{240}{4080}$
*T* 34 : 6 : 3 1 $\frac{720}{4080}$

2. Three merchants join in trade; F put in 400l. for 9 months; G 680l for 5 months; and H 120l. for 12 months; but by misfortunes loſt goods to the value of 500l. what muſt each man ſuſtain of the loſs?

*An.* { *F muſt loſe* £213 : 5 : 4*d.* 3 *qrs.* $\frac{2840}{8440}$
*G* 201 : 8 : 5 0 $\frac{7840}{8440}$
*H* 85 : 6 : 1 3 $\frac{6200}{8440}$

3. D, E, F, hold a paſture in common, for which they pay 20l. *per annum.* In this paſture D had 40 oxen for 76 days, E had 36 oxen for 50 days, and F had 50 oxen for 90 days. I demand what part every one of theſe tenants ought to pay of the 20l.

*An.* { *D ought to pay* £6 : 10 : 2*d.* 1 *qrs.* $\frac{2340}{9340}$
*E* - 3 : 17 : 1 0 $\frac{2000}{9340}$
*F* - 9 : 12 : 8 2 $\frac{5000}{9340}$

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## OF EXCHANGE.

Q. WHAT is Exchange?

A. Exchange is the giving the money, weight, or meaſure of one country, for the like value in bills, money, weight, or meaſure of another country.

Q. What is the courſe of Exchange?

A. It is the value of money agreed on among merchants.

Q. Is the courſe of Exchange always the ſame?

A. No; The Courſe of Exchange riſes or falls almoſt every day, according as money is plenty or ſcarce; or according to the time allowed for payment of the money in exchange; and then the value is ſaid to be above or under *Par.*

Q. What is the Par of Exchange?

A. It is the intrinſic value of any foreign money compared with ſterling money.

Q. What is the Agio?

A. It is a term uſed in ſome countries abroad, eſpecially in Italy, but never in England; and ſignifies the difference between the value of bank notes, or bank money, and current money in ſuch places; that is, it is the difference between the beſt money, uſed in the terms of Exchange, and the worſt, uſed in payment for goods.

Q. What is meant by Bank Notes, or Bank Money?

A. Bank Notes are obtained from foreign bankers, for money lodged in their banks, which money is called Bank Money.

Q. What is Current Money?

A. It is ſuch as paſſes from hand to hand, in the receiving and paying ſuch ſums as are due from one man to another, commonly called Running Caſh.

Q. What is Uſance?

A. It is a certain time allowed for the payment of bills of Exchange; but different according to the uſage or cuſtom of the place where the bill is made, compared with the diſtance of that place on which the bill is drawn; that is the nearer the place on which the bill is drawn, is to the place where it was drawn, the time is the ſhorter; but the further thoſe places are from each other, the length of the time allowed for the payment of that bill, from the date of it is the greater.

*Note*, Bills are payable five ways, *viz.*

1. At ſight.
2. At ſo many days after ſight.
3. At uſance, or a certain length of time agreed on between the two places.
4. At double uſance, which is double the time agreed on between the two places.
5. At marts or fairs, which is to be underſtood at ſome certain days accounted for fairs in the ſame places where the bills are made payable.

Q. What are Days of Grace?

A. In London it is cuſtomary to allow three days to the time mentioned in the Bill, which are called Days of Grace, on the laſt day of which (if it be not on a Sunday, but if it is on Saturday) the bill muſt be demanded, and if not then paid, muſt be immediately proteſted.

*Note*, In ſome places they allow a larger number of days of grace, than we do at London; and in others none at all.

Q. How are queſtions in Exchange proved?

A. By changing the order of them.

### Case I.

Q. What places does London exchange with in dollars, or pieces of eight of Mexico?

A. With Madrid and Cadiz, in Spain; and with Genoa and Leghorn, in Italy.

Q. How do they keep their accompts in Spain?

A. In Ria's and Marvedies.

*Note*, 372 Marvedies make 1 Rial.
8 Rials - - - - - 1 Piece of eight.

Q. What is the Par of Exchange between London and Spain?

A The Par of the Money between London and Spain is that 1900 rials are exactly equal to 51l. ſterling; conſequently 1 rial is worth 6d. 1 qr. $\frac{73}{95}$.

*Note*, 1. Spain gives to London 1 dollar, or piece of eight for an uncertain number of pence ſterling.

2. In Spain they allow 14 days of grace.

Q. How do they keep their accompts in Italy?

A. In livres, ſols, and deniers, ſome few cities excepted

*Note*, 1. 12 Deniers make 1 Sol.
20 Sols make 1 Livre.
5 Livres make 1 Piece of eight of Geneva.
6 Livres 1 Piece of eight at Leghorn.

2. The uſance of Genoa to London is 3 months after date.

3. At Genoa they allow 30 days of grace.

### EXAMPLES.

1. What is the amount of 63l. ſterling in pieces of eight, at 56d. *per* piece? *An.* 270 *pieces of eight.*

2. A factor hath ſold goods at Cadiz for 1468 pieces of eight at 4s. 8d. 2 qrs. *per* piece, how much ſterling is the ſum? *An.* £333 : 7 : 2.

A BILL of EXCHANGE, *viz.* LEGHORN on LONDON.

*Leghorn, July* 31, 1800, *for* 786 *Pieces of Eight of Mexico, at* 55*d. ſterling per Piece of Eight, at* 3 *months.*

"Three months after date, pay this my firſt of exchange
"to Mr. James Le Morte, or order, ſeven hundred and
"eighty-ſix pieces of eight of Mexico, for the Value receiv-
"ed of himſelf, at 55d. ſterling *per* piece, and place it to
"accompt, as *per* advice from

*To Mr. William Matthew, merchant in London.* "Your humble ſervant,
JAMES DOUGLAS."

How much money muſt be received in England for this Bill? *An.* £180 : 2 : 6.

### CASE II.

Q. What places does London exchange with in Ducats?

A. With Venice in Italy.

*Note*, 6 Solidi make 1 Groſs.
24 Groſſes — 1 Ducat.

Q. What is the Par of Exchange between London and Venice?

A. One hundred Livres are worth three Pounds ſterling.

Q. How many ſorts of Ducats are there at Venice?

A. Two ſorts, viz. Ducats Banco, or Bank Ducats, which are uſually given in Exchange; and Ducats Picoli, or Current Ducats, which are uſually bargained for and paid in the purchaſe of goods and merchandiſe, and are 20 *per cent.* worſe than the Bank Ducats.

*Note.* 1 The Par of the Ducat Banco, is 52 pence ſterling: and the Par of the Ducat Picoli is 40d. ſterling.

2. The uſance of Venice to London and back again is 3 months, or 90 days after date; two uſance is that time doubled.

### EXAMPLES.

1. If 100 Livres are worth 3l. ſterling,—what is 1 Livre worth? *An.* 7*d.* $\frac{1}{5}$ *ſterling.*

2. There are 2000 ducats, at 4s. 4d. each, remitted to London, to be paid in pounds ſterling, what is the amount?
*Anſ.* £433 : 6 : 8.

3. A bill of 100l. ſterling is remitted to Venice, to be paid in ducats at 4s. 4d. each; what is the amount?
*Anſ.* 461 $\frac{28}{52}$ *ducats.*

4. A traveller would exchange 233l. 16s. 8d. ſterling, for Venice ducats, at 4s. 9d. *per* ducat; how many muſt he have?
*Anſ.* 984 $\frac{32}{57}$ *ducats.*

A Bill of Exchange, *viz.* Venice on London.

*Venice, Auguſt 17th,* 1791, *for* 4000 *Ducats Banco, at* $54\frac{1}{4}$*d. ſterling per Ducat, at uſance.*

"At uſance, pay this my firſt Bill of Exchange to Mr. A-
"braham Jennings, or order, four thouſand ducats, at fifty-
"four pence farthing ſterling *per* ducat, value received, and
"place it to the accompt of

*To Samuel Jones, Eſq.* }
*merchant in London.* }
"Your humble ſervant,
"WILLIAM SHERSTON."

I demand the value of this bill in ſterling money?
*Anſ.* £904 : 3 : 4.

Another, *viz.* London on Venice.

*London, September* 14, 1791, *for* 904*l.* 3*s.* 4*d. ſterling, to be paid at Venice, in Ducats, at* $54\frac{1}{4}$*d. ſterling per ducat Banco, at Uſance.*

"At uſance, pay this my ſecond bill of exchange, my firſt
"not paid, to Mr. Samuel Dobbins, or order, nine hundred
"and four pounds three ſhillings and four pence ſterling, in
"ducats, at fifty-four pence farthing per ducat, value in my-
"ſelf, and place it to accompt as *per* advice from

*To Mr. James Torriano,* }
*merchant, at Venice.* }
"Your humble ſervant,
"MICHAEL TASSIO."

What is the value of this bill in ducats banco?
*Anſ.* 4000 *ducats.*

### Case III.

Q. What places does London exchange with for French Crowns?

A. With Paris, Lyons, Rouen, &c. in France.

Q. How do they keep their accompts in France?

A. In Livres, Sols, and Deniers.

*Note* 1, 12 Deniers make 1 Sol.
20 Sols make 1 Livre.
3 Livres make 1 Crown.

2. The Livre is imaginary.

3. By an order of Lewis XV. their money is brought to the Engliſh ſtandard for the benefit of trade.

Q. What is the Par of Exchange between London and France?

A. One livre is worth 18d. ſterling; and one crown is worth 4s. 6d. ſterling,

*Note,* In France they allow 10 days of grace; but when bills are drawn at ſight, they are payable the ſame day.

2. The uſance between France and London is one month, conſiſting of 30 days.

*Examples.*

1. A bill of 200l. is remitted to Paris by a merchant in London; what is the value in French crowns, at 4s. 6d. each? *Anſ.* $888\frac{48}{54}$ *crowns.*

2. There are 800 French crowns, at 4s. 6d. each, remitted to London by a merchant in Paris; what is the value in pounds ſterling? *Anſ.* £180 *ſterling.*

A BILL of EXCHANGE *viz.* PARIS on LONDON.

*Paris, September* 17, 1793, *for* 1000 *Crowns, at* 4*s.* 2*d. at* 2 *uſance.*

"At double uſance, pay this my ſecond bill of exchange,
" my firſt not paid, to Mr. James Jackſon, or order, the ſum
" of one thouſand crowns, at four ſhillings and two-pence
" *per* crown, value received, and place it to accompt, as *per*
" advice of

*To Mr. Simon Surepay,*
*London.*

" Your humble ſervant,
DANIEL ARBOTT."

What is the value of this bill in ſterling money?

*Anſ.* £208 : 6 : 8.

## Caſe IV.

Q. What places does London exchange with for Mill-reas;

A. With Oporto and Liſbon, &c. in Portugal; and with the Iſland of Madeira.

Q. How do they keep their accompts in Portugal?

A. In Reas.

*Note*, 1, 1000 reas make 1 mill-rea.

2. They ſeparate the reas from the mill-reas by ſome particular mark thus, 687 ⊖ 496, that is 687 mill-reas, and 469 Reas, which is the ſame with 687496 Reas.

3. Very near 14 Reas, or $13\frac{1}{3}$ reas make one penny English.

Q. What is the Par of exchange between London and Portugal?

A. One Mill-rea is worth 5s. $7\frac{1}{2}$d. which appears thus:

800 Reas (or 8 Teſtoon Piece) are = 4s. 6d.
200 Reas (or fourth Part) = 1 $1\frac{1}{2}$

1000 5 $7\frac{1}{2}$

*Note,* The uſance between London and Portugal is two months, or 60 days after date.

### EXAMPLES.

1. If a bill is drawn from Liſbon of 1432 mill-reas, at 6s. 8d. *per* piece ;—how much Engliſh money is that bill ?

*Anſ.* £477 : 6 : 8.

2. If a bill be drawn from London of 1333l. 6s. 8d. ſterling, how much is it at Liſbon in mill-reas, at 6s. 8d. each ?

*Anſ.* 4000 *mill-reas.*

A BILL of EXCHANGE, *viz.* LISBON on LONDON

*Liſbon, October* 14, 1791, *for* 4761 Θ 764 *at* 5*s.* 8*d. at uſance.*

" At uſance pay this my firſt of exchange to Mr. Henry
" Sozomon, or order, four thouſand ſeven hundred and ſixty-
" one mill-reas, ſeven hundred and ſixty-four reas, at five
" ſhillings and eight-pence ſterling *per* mill-rea, value receiv-
" ed ; and place it to the accompt of

*To Mr. Jacques Joliffe,*
*merchant in London.*

" Your humble ſervant,
" JOHN MINORS."

What is the value of this bill in ſterling money ?

*Anſ.* £1349 : 3 : 3*d.* 3 *qrs.* $\frac{808}{1000}$.

### CASE V.

Q. What place does London exchange with for Ducatoons, Crowns, or Ecues ?

A. With Florence, in Italy.

Q. How do they keep their accompts in Florence ?

A. In ecues, ſols, and deniers picoli, or current.

*Note.* 12 Deniers make 1 ſol,
20 Sols make 1 ecu, crown or ducatoon.

Q. What is the Par of Exchange between London and Florence ?

A. One ecu, crown or ducatoon is worth 60d. ſterling.

*Note.* The uſance between Florence and London, is 3 months or 90 days after date.

### EKAMPLES.

1. A bill of 120 ducatoons is remitted from Florence, at 53d. each ; what is the value in pounds ſterling ?

*Anſ.* £ 26 : 10*s.*

2. A Bill of 120l. 16s. 8d. is drawn from London ;—what is the value at Florence in ducatoons, or ecues, at $53\frac{1}{2}$d. each ?

*Anſ.* $990\frac{70}{107}$ *ecues.*

A BILL of EXCHANGE, *viz.* FLORENCE on LONDON.

*Florence, October* 19, 1791, *for* 1876 *Ecues, at* 63*d. ſterling* per *Ecu, at uſance.*

" At uſance, pay this my third of Exchange, my firſt and
" ſecond not paid, to Mr. Jonathan Farmento, or order,
" one thouſand 876 ecues, at 63d. ſterling ; *per* ecu, value
" received, and place it to the accompt of

*To Mr. John Jameſon,*
*merchant, in London.*

" Your humble ſervant,
" MICHAEL TASSIONI."

What is the value of this bill in ſterling money?

*Anſ.* £492 : 9s.

### CASE VI.

Q. What place does London Exchange with for Florins?

A. With Frankfort, in Germany.

Q. How do they keep their accompts in Frankfort?

A. In Goulds, Cruitzers and Deniers, or Fennings.

*Note*, 8 Fennings, or 4 Deniers make 1 Cruitzer.
60 Cruitzers make 1 Gould or guilder.

Q. What is the Par of Exchange between London and Frankfort?

A. Twenty florins are equal to 3l. ſterling.

*Note*, When they exchange or negotiate bills for London, Holland, or Flanders, the bills are paid in goulds of 65 cruitzers; and for France, Hamburgh, and Italy, in goulds of 60 cruitzers: and ſometimes in rix-dollars, at 4s. 6d. ſterling, and at ſo much per cent. profit or loſs.

### EXAMPLES.

1. If 20 florins are equal to 3l. ſterling, what is the worth of 1 florin? *Anſ.* 3*s. ſterling*

2. If 1000l. ſterling be remitted to Frankfort, what is the value in florins at 39d. per piece? *Anſ.* 6153 $\frac{33}{39}$ *florins.*

3. If 100 florins at 40½d. each, be remitted from Frankfort to London, what is the value in pounds ſterling? *Anſ.* £16 : 17 : 6.

A BILL OF EXCHANGE, *viz.* LONDON ON FRANKFORT.

*London, September* 12, 1791, *for* 763*l.* 10*s. ſterling to be paid in Florins, at* 41*d. ſterling each, at uſance.*

"At uſance, pay this my ſecond of exchange, my firſt
"not paid, to Mr. Jacobus Sanderſon, or order, ſeven hun-
"dred and ſixty-three pounds ten ſhillings ſterling, in florins,
"at 41d. ſterling *per* florin, value received, and place it to
"accompt as *per* advice from

*To Mr. William Maron,* *merchant in Frankfort.* } "Your humble ſervant,
"JAMES JOHNSON."

What is the value of this bill in florins?

*Anſ.* 4469 $\frac{11}{41}$ *florins.*

### CASE VII.

Q. What places does London exchange with by the pound Flemiſh or pound ſterling?

A. With Antwerp, Bruſſels, Amſterdam, Rotterdam, and all parts of the Spaniſh and United Provinces. Alſo with Hamburgh in Germany.

Q. How do they keep their accompts in theſe places ?

A. Some in pounds, ſhillings and pence, as in England ; and others in guilders, ſtivers and pennics.

Note 1, 16 Pennics make 1 Stiver.
20 Stivers 1 Guilder. Alſo
6 Stivers 1 Shilling
6 Guilders 1 Pound Flemiſh.

2. The Par of Exchange between London and Holland is that 9l, ſterling are equal to 100 florins.

3. A florin is worth 3s. 2d. $\frac{2}{5}$ Flemiſh.

4. The Prices of the Exchange at London, Hamburgh and Amſterdam, are ſaid to have a very great influence upon all the reſt of Europe.

Q What is the Par of Exchange between London and Antwerp ?

A. Sixteen pounds Flemiſh are equal to nine pounds ſterling : So that 1l Flemiſh is equal to 11 ſhillings and 3 pence ſterling, and 1l. ſterling is equal to 35s. 6d $\frac{2}{5}$ Flemiſh.

### EXAMPLES.

1. Being deſirous to remit to my correſpondent at London, the ſum of 2000l. 12s. 6d Flemiſh, to diſpoſe of according to my order, exchange at 34s. 6d. Flemiſh *per* pound ſterling ; —how much money ſterling ſhall I be creditor for in the city of London aforeſaid ? *Anſ.* £1159 ; 15 : 7*d.* 3 *qrs.* $\frac{120}{414}$.

2. My correſpondent in England gives me notice that he has diſburſed in merchandiſe upon my account, the ſum of 1000l. ſterling ;—what ſum muſt I anſwer for that in Holland, the courſe of Exchange being at 33s. 4d. Flemiſh for one pound ſterling ? *Anſ* £1666 : 13 : 4 *Flemiſh.*

*Note,* When the courſe of Exchange is at 33s. 4d. Flemiſh for 1 pound Sterling, then to bring Flemiſh money into Engliſh money, multiply the Flemiſh money by 3, and divide that product by 5, the quotient will give the anſwer, in pounds ſterling, and the contrary.

3 My correſpondent in Rotterdam ſends me word, that he has diſburſed upon my account the ſum of 3060 guilders and 15 ſtivers,—what ſum muſt I anſwer for that at London, the courſe of Exchange being at 37s. 9d. Flemiſh *per* pound ſterling ? *Anſ.* £270 5*s.* 3*d.* 2 *qrs.* $\frac{138}{458}$.

*Note,* A Stiver is 2d. Flemiſh, and a Guilder 40d.

4. A merchant delivered at London 120l. ſterling, to receive 147l. Flemiſh in Amſterdam ;—how much was 1l. valued at in Flemiſh money ? *Anſ.* £ 1 : 4 : 6.

5 If 1 florin is worth 3s. $2\frac{2}{5}$d. Flemiſh, and 100 florins are equal to 9l. ſterling ;—how much is the real worth of 1l. ſterling in Flemiſh money ? *Anſ.* 35*s.* $6\frac{5}{9}$*d.*

As 1 fl, : 3s, $2\frac{2}{5}$d, : : 100 fl : 16l, Flem.
As 9 : 16 0 : : 1 : 35s, $6\frac{5}{9}$d Flem.

## *Of reducing the current money of Holland into Bank-money, and the contrary.*

### EXAMPLES.

1. Being in Holland, I have 1000 guilders, current money, which I would turn into Bank-money, the agio being at 5 guilders *per cent.* how much is it?

*Anſ.* 952 *guilders banco,* $\frac{40}{105}$.

G Cur. G. B. G.Cur. G. B.
As 105 : 100 : : 1000 : 952,$\frac{40}{105}$.

2. My correſpondent in Amſterdam having wrote me word that he had by him of mine 2763 guilders, 15 ſtivers, currency, I have directed him to turn the ſame into Bank-money, the agio being (as I am informed) 5$\frac{1}{2}$ guilders *per cent.* I demand how much Bank-money it will make?

*Anſ* 2619 *guilders,* 13 $\frac{77}{211}$ *ſtivers Bank-money.*

G. Cur G. B. G S. Cur. G. B. St.
As 105.$\frac{1}{2}$ : 100 : : 2763 „ 15 : 2619 13$\frac{77}{211}$

3. Holland is indebted to London 7681 guilders current money, and would know how much ſterling it will amount to, exchange at 35s. 6d. banco *per* pound ſterling, agio at 5 *per cent.*—how much is it? *Anſ.* £686 : 17 : 6*d.*$\frac{60}{210}$ ſterling.

G C. G. B°. G. C. G. B°. St. Pen.
As 105 : 100 : : 7681 : 7315 4 12 $\frac{20}{105}$.
s. d. l. St. G B°. St. Pen.
As 35 6 : 1 : : 7315 5 12 . £686 : 17 : 6*d.* 1 *qr.*

4. Amſterdam remits to London 1090 guilders, 17$\frac{1}{2}$ ſtivers, at 33s. 8d. banco *per* pound ſterling;—what will this remittance amount to at London in ſterling money?

*Anſ.* £108 : 0 : 1*d* 3 *qrs* $\frac{52}{204}$ *ſterling.*

*Note,* The above money is ſuppoſed to be reduced into bank-money already.

s. d. l. St. G. St. B°.
As 33 8 : 1 : : 1090 „ 17$\frac{1}{2}$ : £108 : 0 : 1d. 3 qrs. $\frac{52}{204}$.

## *Of the Sale of Gold in Holland.*

*Note,* All gold is bought and ſold at Amſterdam by weight; that is, 355 guilders current per mark of that weight.

### EXAMPLES.

A merchant in London ſends over to his correſpondent at Amſterdam 1000 moidores, valued at 27s. ſterling each; the charges on ſhipping came to 5l 19s. 6d. When they came to the place conſigned, and were weighed, they amounted to 14209 guilders 14 ſtivers currency, all charges there deducted;—I demand what was their value in Engliſh money, and how much the London merchant gained or loſt by his moidores, admitting the agio to be 5 guilders *per cent.* and the courſe of exchange 33s. 6d. B° Flemiſh *per* pound ſterling.

*Anſ.* £12 : 15 : 4 *loſs.*

1. 1000 Ms. + 5l. 19s. 6d. = 1355l. 19s. 6d.
G. G. G. St. G. St.

2. As 100 : 5 : : 14209 „ 14 : 710 „ 9
Gu. St. Gu. St. Gu. St.

3. As 14209 „ 14 — 710 „ 9 = 13499 „ 5
s. d. l. G. S l. s d.

4. As 33 6 : 1 : : 13499 „ 5 : 1343 4 2

5. 1355l. 19s. 6d. — 1343l. 4s. 2d. = 12l. 15s. 4d.

A BILL of EXCHANGE *viz.* London on Rotterdam.

*London, September* 14, 1793, *for* 436*l.* 17*s. ſterling, at* 34*s.* 6*d. Flemish per pound ſterling, at uſance.*

"At uſance, pay this my firſt of exchange, to Jacob Van "Hoove, or order, four hundred and thirty-ſix pounds "ſeventeen ſhillings ſterling, value received of William Johnſon, Eſq. and place it to accompt, as *per* advice from

*To Mr. James Juliers,* } "Your humble ſervant,
*merchant, Rotterdam,* } "THOMAS CARTWRIGHT."

What is the value of this bill in Flemiſh money ?

*Anſ.* £753 : 11 : 3 : 3 *qrs.* $\frac{12}{20}$.

Alſo in guilders and ſtivers ? *Anſ.* 4521 *guil.* 7 *ſtiv.*

| *s.* | *d.* | *l.* | *s.* |
|---|---|---|---|
| 34 | 6. | 436 | 17 |
| 12 | | | 414 |
| 414 | | 1747 | 8 |
| | | 4368 | 5 |
| | | 174740 | 0 |

Gu. St.
4|0)18085|5 13(4521 7 *Anſ.*
15

Another, *viz.* Rotterdam on London.

*Rotterdam, September* 19, 1800, *for* 7693 *guilders,* 17 *ſtivers, at* 35*s.* 6*d. Flemish per pound ſterling.*

"At uſance, pay this my ſecond bill of exchange, my firſt "not paid, to James Truelove, or order, ſeven thouſand, ſix "hundred and ninety-three guilders, ſeventeen ſtivers at 35s. "6d Flemiſh per pound ſterling, value received of Jacques "Jacobſon, and place it to accompt, as *per* advice from

*To James Jolles, Eſq ;* } "Your humble ſervant,
*merchant, at London.* } "JOHANNES VAN SCHOOTEN."

What is the value of this bill in ſterling money ?

*Anſ.* £722 : 8 : 6*d* 2 *qr.* $\frac{60}{426}$.

### *To know how much is gained or loſt per cent. on the riſing or falling of the price of Exchange.*

EXAMPLES.

1. London draws upon Holland, for any ſum of money, exchange at 35s. 6d. Flemiſh *per* pound ſterling; in three weeks or a month afterward London draws on Holland again, exchange at 34s. 6d.—I demand what London gains *per cent.* by this negotiation? *Anſ.* £2 : 17 : 11 : 2 *qr.* $\frac{252}{414}$ *gain.*

s. d. s. l. l. s. d. qrs.

As 34 6 : 1 : : 100 : 2 17 11 2$\frac{252}{414}$.

2. London draws upon Amſterdam, exchange at 34s. 6d. Flemiſh *per* pound ſterling; and in five weeks time draws again, the exchange being at 35s. 6d—how much is loſt *per cent.* by this tranſaction? *Anſ.* £2 : 17 : 11 : 2 *qrs.* $\frac{252}{414}$.

*Note,* Hence it is to be obſerved, that the lower the Price of Exchange is, the greater is the gain at London, and the contrary when it is higher. But the caſe is juſt the reverſe at Holland.

## Caſe VIII.

Q. What places does London exchange with by the pound ſterling or pound currency?

A. In all the Britiſh dominions in America, in the Weſt Indies, and in Ireland.

Q. How do they keep their accompts in theſe places?

A. As they do in London, that is, in pounds, ſhillings, pence, and farthings; but with this difference, that in London they call their money ſterling, but in all the Weſtern dominions they call it currency.

Q. Why is the money called Currency in the Weſtern dominions?

A. Becauſe they have very few coins of any ſort circulating among them, excepting in the Engliſh iſlands there; and therefore are obliged to deal in what they call paper money.

*Note,* 1, Notes of hand paſs currently among the people: and in New England they are ſaid to be given for ſo ſmall a ſum as five ſhillings. Now as this paper money is ſubject to many caſualties, it cauſes a very great undervalument of their currency, and is ſometimes, and in ſome places, at 6 or 700 pounds currency for 100 pounds ſterling, or money that is good ſilver or gold.

2. In all the Engliſh iſlands in the Weſt Indies, they have ſo great a plenty of foreign coins, that their currency is ſometimes at no greater diſcount than 25 *per cent.* or 125l. currency for 100l. ſterling, and ſeldom more than 50 *per cent.*

3. The weights and meaſures, in the Britiſh colonies and plantations are the ſame as thoſe in London, differing only in their kentals or hundred weight; their hundred being only 100 lb. Avoirdupois, and that at London, 112lb.

Q. What foreign coins uſually paſs in the Britiſh colonies and plantations ?

A. Theſe following ; the values of which were aſcertained by an act of parliament made in the ſixth year of Queen Anne.

| | *Weight.* | | *True Val.* | | *Curr. Value.* | | |
|---|---|---|---|---|---|---|---|
| | *dwt.* | *gr.* | *s.* | *d.* | *s.* | *d.* | *f.* |
| Pieces of eight (old plate of Seville) | 17 | 12 | 4 | 6 | 6 | 0 | 0 |
| Ditto of new - - - | 14 | 0 | 3 | 7¼ | 4 | 9 | 2⅔ |
| Mexico ditto - - - | 17 | 12 | 4 | 6 | 6 | 0 | 0 |
| Pillar ditto - - - | 17 | 12 | 4 | 6¾ | 6 | 0 | 0 |
| Peru ditto (old plate) - - | 17 | 12 | 4 | 5 | 5 | 10 | 2⅔ |
| Croſs dollars - - - | 18 | 0 | 4 | 4¾ | 5 | 10 | 1⅓ |
| Ducatoons of Flanders - | 20 | 21 | 5 | 6 | 7 | 4 | 0 |
| French crowns or ecues - - | 17 | 12 | 4 | 6 | 6 | 0 | 0 |
| Cruſadoes of Portugal - - | 11 | 4 | 2 | 10¼ | 3 | 9 | 2⅔ |
| Three guilder-pieces of Holland | 20 | 7 | 5 | 2¼ | 6 | 10 | 3⅔ |
| Old rix-dollars of the Empire | 18 | 10 | 4 | 6 | 6 | 0 | 0 |

*Note.* 1. Pieces of the ſame weight, and not of the ſame value, may be preſumed to be occaſioned by the difference of fineneſs.

2. To remedy the inconveniences, which were cauſed by the different rates at which pieces of the ſame ſpecies were current, it was ordered by proclamation, and confirmed by the aforementioned act of parliament, that after the firſt day of January, 1704, no Pillar, Mexico, or Seville pieces of eight, though of full weight as above, ſhall be received nor paid at above ſix ſhillings a-piece, and the halves, quarters, and other leſſer pieces in proportion. And the ſaid act enjoins, That if any one ſhall receive or pay any of the ſaid pieces for any more than above ſpecified, ſuch perſons ſhall forfeit ten pounds.

### EXAMPLES.

1. A merchant in New England ſtands indebted to his correſpondent in London, in 4960l. 17s. 6d. currency ;—what ſum muſt he anſwer for that at London aforeſaid, when the currency is at 300 *per cent.*? *An* £1653 : 12 : 6 *ſterling.*

2. My correſpondent in Georgia ſtands indebted to me for merchandiſe in the ſum of 120l. 6s. 9½d. ſterling ; how much is that in their currency, at 500 *per cent* ?

*An.* £601 : 13 : 11½ *currency.*

3. Trading to Jamaica, my employer there owes me 176l. 12s. 8d. ſterling :—how much is that in their currency, at 25 *per cent.*? *An.* £220 : 15 : 10 *currency.*

4. I have lately purchaſed in Ireland, effects to the value of 400l. 17s. 9d. of that place ; what ſum muſt I anſwer for that at London, exchange at 10 *per cent.*?

*An.* £364 : 8 : 10 1 *qr.* $\frac{120}{264}$.

5 My correſpondent at London, draws upon me for 364l. 8s. 10½d. ſterling ;—what ſum muſt I anſwer for that at Dublin, exchange at 8½ *per cent* ? *An.* £395 : 8 : 5 $\frac{1434}{2000}$.

## CASE IX.

*Q.* What place does London exchange with for the crown or rix-dollar?

*A.* With Geneva in Switzerland?

Q. How do they keep their accompts in Geneva?

*A.* In livres, ſols, and deniers.

*Note*, 1, 12 Deniers make 1 ſol,
20 ſols, —— 1 livre.
3 livres —— 1 rix-dollar.

2. The Par is that 1 rix-dollar is equal to 4s. 6d. ſterling; but in exchange it goes for 50d. to 60d. ſterling.

### Examples.

1. London draws upon Geneva for 796l. 10s. 6d. ſterling;—what ſum does that amount to in rix-dollars at 53d *per* dollar? *Anſ.* 3606 $\frac{48}{53}$ *rix-dollars.*

2. A merchant in Geneva draws upon his correſpondent at London for 1960 livres, exchange at 56d. *per* rix-dollar;—how much ſterling muſt be paid at London to anſwer that bill? *Anſ.* £152 : 8 : 10$\frac{1}{2}$.

$\frac{1060}{3}$=653$\frac{1}{3}$ 1 : 56 : 653$\frac{1}{3}$ : 152*l.* 8*s.* 10$\frac{1}{2}$*d.* +

A BILL OF EXCHANGE, *viz.* LONDON ON GENEVA.

*London,* *October* 19, 1800, *for* 376*l* 11*s* 8*d ſterling, to be paid in rix-dollars, at* 58*d. ſterling, at uſance.*

" At uſance, pay this my only bill of exchange to Mr.
" Janſon Gramonville, or order, three hundred and ſeventy-
" ſix pounds eleven ſhillings and eightpence ſterling, in rix-
" dollars, at 58d. ſterling *per* rix-dollar, value received, and
" place it to the account of

*To Mr. Abraham Schulhauſon, merchant in Geneva.*

" Your humble ſervant,
" JACOBUS SCOMBERG."

What is the value of this bill in rix-dollars? *Anſ.* 1558 $\frac{16}{58}$ *rixdollars.*

## CASE X.

Q. What particular piece of money does London exchange with Denmark for?

*A* For rix-dollars; one being valued at about 4s. 6d. ſterling.

*Q.* How do they keep their accompts in Denmark?

*A.* In marks and ſhillings.

Note, 1. 16 Shillings make 1 mark.
6 marks —— 1 rix-dollar.

2. The rix-dollar, in exchange, goes for 45d. to 58d. ſterling.

### Examples.

1. London draws on Copenhagen in Denmark for 184l. 16s. 7d. ſterling;—what ſum muſt be anſwered for that in rix-dollars at 50d. each? *Anſ* 887 $\frac{9}{50}$ *dollars.*

2. My correſpondent in London ſtands indebted to me, according to my books, in the ſum of 1000 rix-dollars,—what ſum muſt he anſwer for that at London aforeſaid, when the rix dollar, by way of exchange, is valued at $58\frac{1}{2}$d.?

*Anſ.* £243 : 15.

3 A merchant in London draws upon his correſpondent in Copenhagen for 400l. ſterling, but will give no more for a rix-dollar than 55d. ſterling, that being the price of exchange;—how many rixdollars muſt he receive, and what is his whole loſs, and the loſs *per cent* they being above par?

*An.* $1745\frac{25}{55}$ *rix-dollars. The whole loſs was* £7 : 5 : 3.
*and the loſs per cent. was* £1 : 16 : $2\frac{3}{4}$.

d. Dol. l. Dol.
As 55 : 1 : : 400 : $1745\frac{25}{55}$
$1745\frac{1}{2}$ at 4s. 6d =392l. 14s. 9d. at par.
400l. — 392l. 14s 9d.=7l. 5s. 3d. loſs.
$\frac{7:5:3}{4}$=1l. 16s. $3\frac{1}{4}$d. loſs *per cent.*

## CASE II.

Q. What place does London exchange with for the copper-dollar?

*A.* With Stockholm in Sweden.

*Q.* How do they keep their accompts in Stockholm?

*A.* In rix-dollars, copper-dollars and runſtics.

Note 1, 32 Runſtics make 1 Copper-dollar.
6 Copper-dollars 1 Rix-dollar.

2. The par of the rix-dollars is equal to about 6s. ſterling; conſequently the par of the copper-dollar is equal to 1s. ſterling, or 20 copper-dollars make 1l. ſterling, though the courſe of exchange is ſometimes to 28 or 30 copper-dollars per pound ſterling.

3. In England, ſums of money are paid in the beſt ſpecie, viz. guineas, by which means 1000l. or more may be put into a ſmall bag, and conveyed away in the pocket; but in Sweden they often pay ſums of money in copper, and the merchant is obliged to ſend wheelbarrows inſtead of bags to receive it.

### Examples.

1. A Merchant in Stockholm draws upon his correſpondent in London for 1184 rix dollars;—what ſum muſt he anſwer for that in London aforeſaid, when the courſe of exchange is at par?

*Anſ.* £355 : 4.

2. Stockholm draws upon London for 1276 rix-dollars; what ſum muſt London anſwer for that, exchange at 25 copper-dollars per pound ſterling, and what is gained or loſt by the drawer at Stockholm aforeſaid? *An.* £306 : 4 : 9 $2\frac{2}{5}$ *qrs. the bill; and the drawer loſes* £76 : 11 : 2 : 1 *qr.* $\frac{3}{5}$.

As 25 : 1 : : 1276×6 : 306 4 9 $2\frac{2}{5}$, *the value of the bill.*
As 25 : 5 : : 7656 : 76 11 2 $1\frac{3}{5}$, *loſs.*

Having given ſeveral Bills of Exchange to be reduced into ſterling or foreign money; it may not be amiſs to give the form how a bill book ſhould be kept, that a merchant may know at ſight what Bills he has to pay, and what to receive; and when to pay and receive them.

1. Bills payable, *i. e.* ſuch as you have accepted.

| The Drawer's name and place of reſidence. | Date of the Bill. | The time of payment. | Payable to whom or order. | The Sum drawn for. | Price of Exchange | For or by whom accepted, and place of abode. | The ſum ſterling. | When due. | Paid, or refus'd acceptance. |
|---|---|---|---|---|---|---|---|---|---|
| *Will Sherſton, of Venice.* | 17 *Aug.* | 3 Months. | *Abraham Jennings* | Ducats B° 4000 | Sterling 54¼*d.* | *William Denny Rood Lane.* | *l.* *s.* *d.*<br>904 3 3 | 15 *Nov.* | Paid. |

2. Bills Receivable, *i. e.* ſuch as you have in your poſſeſſion.

| The Drawer's name and place of reſidence. | Date of the Bill. | The time of payment. | Payable to whom or order, | The Sum drawn for. | Price of Exchange | For or by whom accepted, and place of abode. | The ſum ſterling. | When due. | Received, or returned proteſted for non-acceptance or non-payment. |
|---|---|---|---|---|---|---|---|---|---|
| *Mich. Taſſioni, Florence.* | 19 *Oct.* | 3 *months.* | *James Edwards* | Ecues. 1876. | Sterling 63*d.* | | *l.* *s.*<br>492 10 | 17 *Jan.* | Proteſted for non-acceptance. |

## Caſe XII.

## *Of the Compariſon of Weights and of Meaſures.*

### Examples.

1 If 112lb at London make 99lb. at Liſbon,—how many lb. at London are equal to 1049lb. at Liſbon?

*Anſ.* 1186lb. $\frac{74}{99}$.

2 If 112lb. at London make 98lb. at Roan,—how many lb. at Roan are equal to 1000lb. at London? *Anſ.* 875*lb.*

3. If 100 ells Engliſh make 108 braces at Venice, how many ells Engliſh are equal to 1000 braces at Venice?

*Anſ.* 925 *ells* 4 *qrs* 2 *na.* $\frac{56}{108}$.

4. If 100 ells at London make 145 ells at Vienna,—how many ells at Vienna are equal to 10 ells at London?

*Anſ.* 14$\frac{1}{2}$ *ells.*

Note, Hence appears the reaſon of thoſe rules, laid down in conjoined proportion, for placing the laſt number in the queſtion either on the right hand, or the left, as the nature of the queſtion requires.

| | | | |
|---|---|---|---|
| | lb. Liſ. | lb. Lon. | lb. Liſ. |
| Ex. 1. | As 99 : | 112 : : | 1049 |
| | | lb. | lb. |
| | | 112 = | 99 |
| | | 1049 | |
| | lb. Lon. | lb. R. | lb. Lon. |
| Ex. 2 | As 112 : | 98 : : | 1000 |
| | lb. | lb. | |
| | 112 = | 98 | |
| | | 1000 | |

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## Of the DOUBLE RULE of THREE.

Q. BY what is the Double Rule of Three known?

A. By five terms, which are always given in the queſtion to find a ſixth.

Q. In what proportion is the ſixth term to be found?

A. If the proportion is direct, the ſixth term muſt bear ſuch proportion to the fourth and fifth, as the third bears to the firſt and ſecond: But if the proportion is inverſe, then the ſixth term muſt bear ſuch proportion to the fourth, and fifth, as the firſt bears to the ſecond and third, or as the ſecond bears to the firſt and third.

*Note*, It is to be obſerved here, as in the Single Rule of Three, that direct proportion is when more requires more, or leſs requires leſs, and inverſe proportion is when more requires leſs, or leſs requires more.

Q. What do you obſerve concerning the Five Given Terms?

A. That the three firſt Terms are a ſuppoſition; the two laſt are a demand.

Q. How muſt the Numbers given in the Queſtions be ſtated?

A. By two ſingle rules of three: Or otherwiſe thus:

1. Let the principal cauſe of loſs or gain, intereſt or decreaſe, action or paſſion, be put in the firſt place.

2. Let that which betokeneth time, diſtance of place, and the like, be put in the ſecond place; and the remaining one in the third place.

3. Place the other two terms under their like in the ſuppoſition.

4. If the blank falls under the third term, multiply the firſt and ſecond terms for a diviſor, and the other three for a dividend.

5. If the blank falls under the firſt or ſecond term, multiply the third and fourth terms for a diviſor and the other three for a dividend; and the quotient will be the anſwer.

Q. How are the following queſtions proved?

A. Let them be varied; or elſe work the ſame Queſtions by two ſingle rules of three.

### *Examples.*

1. If 7 men can reap 84 acres of wheat in 12 days;—how many men can reap 100 acres in 5 days? *Anſ.* 20 *men.*

2. If 7 qrs. of malt are ſufficient for a family of 7 perſons for 4 months,—how many qrs. are enough for 46 perſons 10 months? *Anſ.* 115 *qrs.*

3. If 8 reapers have 3l. 4s. for 4 days work;—how much will 48 men have for 16 days work? *Anſ.* £76 : 16s.

4. If 10 buſhels of oats be enough for 18 horſes 20 days;—how many buſhels will ſerve 60 horſes 36 days? *An.* 60 *buſh.*

5. If a footman travels 240 miles in 12 days, when the days are 12 hours long;—how many days may he travel 720 miles in, of 16 hours long? *An.* 27 *days.*

6. If 56 lb. of bread will be ſufficient for 7 men 14 days,—how much bread will ſerve 21 men 3 days? *An.* 36 *lb.*

7. If 700l. in half a year raiſe 14l. intereſt;—how much will 400l. raiſe in 5 years? *An.* £80.

8. If 30s. be the hire of 8 men for 3 days;—how many days muſt 20 men work for 15l.? *An.* 12 *days.*

9. If 4 reapers have 24s. for 3 days work;—how many men will earn 4l. 16s. in 16 days? *An.* 3 *men.*

10. An uſurer put out 86l. to receive intereſt for the ſame, and when it had continued 8 months he received for principal and intereſt 88l. 17s 4d.—I demand at what rate *per cent. per annum* he received intereſt? *Anſ.* 5*l. per cent.*

11. What is the intereſt of 200l. for 3 years and ¾, at 5 *per cent. per annum?* *Anſ* £37 : 10*s.*

12. What is the intereſt of 400l. for a week at 5 *per cent. per annum?* *Anſ.* 7s. 8*d.* 1 *qr.* $\frac{12}{52}$.

13. What is the intereſt of 120l. for 126 days, at 4 *per cent. per annum?* *Anſ* £1 : 13 : 1 : 2 *qrs.* $\frac{258}{365}$.

*Note,* The rule for working queſtions in Simple Intereſt for days, p. 67, is taken from this rule, as appears from this laſt example.

## *Of Conjoined Proportion.*

Q. What is Conjoined Proportion?

A. Conjoined Proportion is when the coins, weights, or meaſures of ſeveral countries are compared in the ſame queſtion; or it is a linking together of many proportions.

### Case I.

Q. How are queſtions anſwered in this caſe?

A. When it is required to know how many of the firſt ſort of coin, weight, or meaſure, mentioned in the queſtions, are equal to a given number of the laſt; then

1. Place the numbers alternately, beginning at the left hand, and let the laſt number ſtand on the left hand.

2. Multiply the firſt rank continually for a dividend, and the ſecond for a diviſor.

*Note,* See the Note in compariſon of weights and meaſures p. 91 for the reaſon of this Rule.

Q. How is conjoined proportion proved?

A Make as many Single Rules of Three as the nature of the queſtion requires.

### Examples.

1. If 100lb. Engliſh make 95lb. Flemiſh, and 19 lb. Flemiſh 25lb. at Bolognia;—how many lb. Engliſh are equal to 50lb. at Bolognia? *An.* 40 *lb. Engliſh.*

2. If 25lb. at London be 22lb. at Nuremburgh; 88lb. at Nuremburgh 92lb. at Hamburgh; 46lb. at Hamburgh 49lb. at Lyons;—how many lb. at London are equal to 98 lb. at Lyons? *Anſ.* 100 *lb.*

3. If 6 braces at Leghorn, make 3 ells Engliſh; 5 ells Engliſh 9 braces at Venice;—how many braces at Leghorn will make 45 braces at Venice? *Anſ. 50 braces at Leghorn.*

4. If 3 ells Engliſh make 6 braces at Leghorn, and 150 braces at Leghorn 135 braces at Venice;—how many ells Engliſh are equal to 27 braces at Venice?

*Anſ. 15 ells Engliſh.*

### CASE II.

Q. How are queſtions anſwered in this caſe?

A. When it is required to know how many of the laſt ſort of coin, weight, or meaſure, mentioned in the queſtion, are equal to a given number of the firſt: then,

1. Place the numbers alternately, as in Caſe I. but let the laſt number ſtand on the right hand.

2. Multiply the ſecond rank for a dividend, and the firſt for a diviſor.

### EXAMPLES.

1. If 10lb. at London make 9 lb. at Amſterdam; 90lb. at Amſterdam 112 lb. at Thoulouſe;—how many lb. at Thoulouſe are equal to 50lb. at London? *An 56lb. at Thoulouſe.*

2. If 20 braces at Leghorn be equal to 10 vares at Liſbon; 40 vares at Liſbon to 80 braces at Lucca;—how many braces at Lucca are equal to 100 braces at Leghorn?

*An. 100 braces at Lucca.*

## OF ALLIGATION.

Q. HOW many kinds of Alligation are there?

A. Two: Alligation Medial, and Alligation Alternate.

### *Of Alligation Medial.*

Q. What is Alligation Medial?

A. Alligation Medial is when the quantities and price of ſeveral things are given, to find the mean price of the mixture compounded of thoſe things.

Q. What is the Rule?

A. As the whole compoſition,
Is to its total value;
So is any part of the compoſition
To its mean price.

*Q.* How is Alligation Medial proved?

A. Find the value of the whole mixture at the mean rate; and if it agrees with the total value of the ſeveral quantities at their reſpective rates, the work is right.

### Examples.

1. A farmer mingled 19 buſhels of wheat at 6s. *per* buſhel, and 40 buſhels of rye, at 4s. *per* buſhel, and 12 buſhels of barley, at 3s. *per* buſhel together;—I demand what a buſhel of this mixture is worth? *An.* 4*s.* 4*d.* 1 *qr.* $\frac{41}{71}$.

2. A farmer mingled 20 buſhels of oats, at 2s. *per* buſhel, and 30 buſhels of beans, at 2s. *per* buſhel, and 20 buſhels of peas, at 3s. *per* buſhel together;—I demand the worth of a buſhel of this mixture? *An.* 2*s.* 3*d.* 1 *qr.* $\frac{5}{7}$.

3. A vintner mingled 5 gallons of Canary, at 8s. *per* gallon, and 6 gallons of Malaga, 7s. *per* gallon, and 4 gallons of white wine, at 6s. *per* gallon together;—I demand what a gallon of this mixture is worth? *An.* 7*s.* 0*d.* 3 *qrs.* $\frac{1}{5}$.

4. A grocer mingled 2 cwt. of ſugar, at 56s. *per* cwt. and 1 cwt. at 43s. *per* cwt. and 2 cwt. at 50s. *per* cwt. together;—I demand the price of 3 cwt. of this mixture? *An.* £7 : 13*s.*

5. An alehouſe keeper mixed 3 ſorts of ale together, viz. 12 gallons at 6d. *per* gallon, 16 gallons at 7d. *per* gallon, and 21 gallons at 9d. *per* gallon;—I demand what 1 gallon of this mixture is worth? *An.* 7*d.* 2 *qrs.* $\frac{23}{49}$.

6. A refiner having 5 lb. of ſilver bullion, of 8 oz. fine, 10 lb. of 7 oz. fine, and 15 lb. of 6 oz. fine, would melt all together;—I demand what fineneſs 1 lb. of this maſs ſhall be? *An.* 6 *oz.* 13 *dwts.* 8 *gr. fine.*

7. A mint-maſter hath 3 lb. weight of gold, 22 carats fine, and 3 lb. of 20 carats fine;—I demand what fineneſs an oz. of this mixture will bear? *An.* 21 *carats fine.*

8. An hoſtler mixing provender for his horſes, would put in a quantity of beans, at 5s. *per* buſhel, with the like quantity of oats, at 3s. 6d. *per* buſhel;— I demand the price of a buſhel of this mixture? *An.* 4*s.* 3*d.*

9. A malſter hath ſeveral ſorts of malt, viz. one ſort at 4s. 6d. another at 4s. and another 3s. 6d. *per* buſhel, and he would mix an equal quantity of each together; I demand the price of a buſhel of this mixture? *An.* 4*s.*

10. A Brewer had ſeveral ſorts of ale, viz. one ſort at 20s. *per* barrel, another at 25s. a third at 30s. and a fourth at 35s. *per* barrel, and he would mix an equal quantity of each together; -- I demand the price of a barrel, and alſo of a gallon of this mixture?

*An* 27*s*. 6*d*. *per barrel, and* 10*d*. 1 *qr*. $\frac{8}{31}$ *per gallon.*

## *Of Alligation Alternate.*

Q. What is Alligation Alternate?

A. Alligation Alternate is, when the rates of ſeveral things are given to find ſuch quantities of them, as are neceſſary to make a mixture, which may bear a certain rate propounded.

Q. How are the rates or prices of the given things to be ordered?

A 1. They muſt be placed one over the other, and the propounded price of the compoſition againſt them; thus,

*Mean rate* $7;\left\{\begin{array}{l}4 \text{ prices}\\ 5 \text{ of the}\\ 6 \text{ Sim-}\\ 8 \text{ ples}\end{array}\right.$

2 Link the ſeveral rates together, in ſuch a ſort, that one greater than the mean rate may be coupled to another which is leſs.

3 Take the differences between the mean rate, and the ſeveral prices, and place them, each againſt his yoke fellow: And for the reſt, obſerve the following caſes,

### CASE I.

Q. What do you obſerve in this firſt caſe?

A. When the prices of the ſeveral things, together with the mean rate of the mixture, are given, without any quantity, to find how much of each ingredient is required to compoſe the mixture; take the difference between each price and the mean rate, and ſet them alternately, and they will be the quantities required.

Q. How are the operations in this and the following caſes proved?

A. They are all proved by alligation Medial.

### EXAMPLES.

1. How much rye at 4s. *per* buſhel, barley, at 3s. *per* buſhel, and oats at 2s. *per* buſhel, will make a mixture worth 2s. 6d. *per* buſhel? *An.* 6 *buſhels of rye*, 6 *buſhels of barley*, *and* 24 *buſhels of oats*.

2. How many raiſins of the ſun at 7d. *per* lb. and Malaga raiſins at 4d. *per* lb. may be mixed together for 6d *per* lb?

*Anſ. 2lb. of raiſins of the ſun, and 1lb. of Malaga raiſins.*

*Note*, Queſtions in this rule do frequently admit of an infinite variety of anſwers, and all in whole numbers; as in this laſt example, where though 2 and 1 do anſwer the queſtion, yet any other two numbers will as truly do the like, as are in the ſame proportion.

|  |  |  |  |
|---|---|---|---|
| For 2 : 1 : : | 4 | : | 2 |
|  | 6 | : | 3 |
|  | 8 | : | 4 |
|  | 16 | : | 8 |
|  | 40 | : | 20, &c. without end. |

A grocer would mix three ſorts of ſugar together, *viz* one ſort at 10d. another at 7d. and another at 6d. *per* lb.—how much of each ſort muſt he take, that the whole mixture may be ſold at 8d. *per* lb.

lb d. lb. d. lb. d.

*Anſ.* 3 *at* 10 ; 2 *at* 7 ; *and* 2 *at* 6 *per pound*

4. A malſter hath ſeveral ſorts of malt, *viz.* one ſort at 4s. *per* buſhel, another at 3s. 6d. a third at 3s. and a fourth at 2s. *per* buſhel; and he is deſirous to mix ſo much of each ſort together, that the whole may be ſold at 2s. 6d. *per* buſhel;—I demand how much he muſt take of each ſort?

Buſh. s. B. s. d. B. s. B. s.

*An.* 6 *at* 4; 6 *at* 3:6; 6 *at* 3, *and* 36 *at* 2 *per Buſh.*

5. A druggiſt had ſeveral ſorts of tea, *viz.* one ſort at 12s. *per* lb. another at 11s. a third at 9s. and a fourth at 8s. *per* pound,—I demand how much of each ſort he muſt mix together, that the whole quantity may be afforded at 10s. *per* lb.

|  | lb. |  | s. p. lb. |  | lb. |  | s. p. lb. |  | lb. |  | s. p. lb |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 *An.* | 2 | *at* | 12 | 2 *An.* | 3 | *at* | 12 | 3 *An.* | 1 | *at* | 12 |
|  | 1 | — | 11 |  | 2 | — | 11 |  | 2 | — | 11 |
|  | 1 | — | 9 |  | 2 | — | 9 |  | 2 | — | 9 |
|  | 2 | — | 8 |  | 3 | — | 8 |  | 1 | — | 8 |

|  | lb. |  | s. p. lb. |  | lb. |  | s. p. lb. |  | lb. |  | s. p. lb. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 *An.* | 1 | *at* | 12 | 5 *An.* | 3 | *at* | 12 | 6 *An.* | 2 | *at* | 12 |
|  | 3 | — | 11 |  | 1 | — | 11 |  | 3 | — | 11 |
|  | 3 | — | 9 |  | 3 | — | 9 |  | 1 | — | 9 |
|  | 1 | — | 8 |  | 2 | — | 8 |  | 3 | — |  |

7. *Anſ. 3lb. of each ſort.*

*Note*, Theſe ſeven anſwers ariſe from as many different ways of linking the rates of the ſimples together.

6. How much alloy muſt I mix with bullion of 10 oz. fine to abaſe the ſame to 8 oz. fine?

*Anſ. to every 8 oz. of bullion of 10 oz. fine put 2 oz. of alloy and that will abaſe it to 8 oz. fine.*

## CASE II.

## *Of Alternation Partial.*

Q. What do we obſerve in this ſecond caſe?

A. When the rates of all the things, the quantity of but one of them, and the mean rate of the whole mixture are given to find quantities of the reſt, in proportion to the quantity given; take the difference between each price, and the mean rate, and place them alternately, as in caſe 1. Then ſay,

As the difference of the ſame name with the quantity given,
Is to the reſt of the differences ſeverally:
So is the quantity given,
To the ſeveral quantities required.

### EXAMPLES.

1. A man being determined to mix 10 buſhels of wheat at 4*s per* buſhel; with rye at 3s, with barley at 2s, and with oats at 1s. *per* buſhel; I demand how much rye, barley, and oats, muſt be mixed with the 10 buſhels of wheat, that the whole may be ſold at 28d. *per* buſhel?

1 *Anſ.*
B. p.
2 2 of rye
5 0 of barley
12 2 of oats

2 *Anſ.*
B.
40 of rye
50 of barley
20 of oats,

3 *Anſ.*
B
8 of rye
10 of barley
14 of oats

4 *Anſ.*
B.
10 of rye
14 of barley
14 of oats

5 *Anſ.*
B. p.
12 2 of rye
5 0 of barley
17 2 of oats

6 *Anſ.*
B
2 of rye
14 of barley
10 of oats

7 *Anſ.*
B
50 of rye
70 of barley
20 of oats

2. A man being determined to mix 12 buſhels of oats, at 18d. *per* buſhel, with barley at 2s. 6d. with rye at 3s. and with wheat at 4s. *per* buſhel; I demand how much barley, rye, and wheat, muſt be mixed with the 12 buſhels of oats, that it may bear the price of 22d *per* buſhel?

*Anſ.* 1 *buſhel of each ſort.*

3. A man being determined to mix 12 buſhels of oats, at 18d. *per* buſhel, with barley at 2s. 6d. with rye at 3s. and with wheat at 4s. *per* buſhel; I demand how much barley, rye and wheat, muſt be mixed with the 12 buſhels of oats, that the whole may bear the price of 2s. 9d. *per* buſhel.

1. *An.*
B.
60 of barley
60 of rye
12 of wheat

2. *An.*
B. p.
2 $1\frac{9}{15}$ of barley
2 $1\frac{9}{15}$ of rye
12 0 of wheat

3. *An.*
B.
10 of barley
10 of rye
12 of wheat

4. *An.*
B.
72 of barley
72 of rye
12 of wheat

5. *An.*
B.
2 of barley
12 of rye
10 of wheat

6. *An.*
B. p.
14 $1\frac{9}{15}$ of barley
2 $1\frac{9}{15}$ of rye
14 $1\frac{9}{15}$ of wheat

7. *An.* 12 *buſhels of each ſort.*

4 A man being determined to mix 12 buſhels oats, at 18d. *per* buſhel, with barley at 2s. 6d. with rye at 3s. and with wheat at 4s. *per* buſhel; I demand how much barley, rye, and wheat muſt be mixed with the 12 buſhels of oats, that the whole quantity may bear the price of 3s. 6d. *per* buſhel?

*An.*
B
12 of barley
12 of rye
84 of wheat

5. A man intends to mix 28 buſhels of oats at 18d. *per* buſhel, with barley as 2s. 6d. with rye at 3s. and with wheat at 4s. I would know how much barley, rye, and wheat ought to be added to the 28 buſheis of oats, that the whole quantity may be afforded at 2s. *per* buſhel?

*An.* 4 *buſhels of each ſort.*

6. A farmer would mix 27 buſhels of peaſe at 18d *per* buſhel, with oats at 28d. and with beans at 30d *per* buſhel; that the whole quantity may bear the price of 20d *per* buſhel; I demand how much oats and beans muſt be mixed with the 27 buſhels of peaſe? *An.* 3 *buſhels of each ſort.*

## CASE III.

### *Of Alternation Total.*

Q What do you obſerve in this third caſe?

A. When the rates of the ſeveral things, the quantity to be compounded, and the mean rate of the whole mixture are given, to find how much of each ſort will make up the quantity: place the differences between the ſeveral prices, and the mean rate, alternately, as in caſe 1. Then ſay,

As the ſum of the differences,  
Is to the whole compoſition:  
So is the difference of each rate,  
To the quantity of the ſame rate.

Examples.

1. A grocer hath four ſorts of ſugar, *viz.* at 8d. *per* lb at 6d. *per* lb. at 4d. *per* lb. and at 2d. *per* lb and he would have a compoſition of an cwt. worth 5d. *per* lb. I demand how much of each ſort he muſt take?

1. *Anſ.*

| lb | d p. lb. |
|---|---|
| 42 | at 8 |
| 14 | 6 |
| 14 | 4 |
| 42 | 2 |
| 112 | |

2. *Anſ.*

| lb | d. p. lb. |
|---|---|
| 14 | at 8 |
| 42 | 6 |
| 42 | 4 |
| 14 | 2 |
| 112 | |

3. *Anſ.*

| lb | oz | dr. | d. p. lb. |
|---|---|---|---|
| 28 | 0 | 0 | at 8 |
| 37 | 5 | $5\frac{4}{12}$ | 6 |
| 9 | 5 | $5\frac{4}{12}$ | 4 |
| 37 | 5 | $5\frac{4}{12}$ | 2 |
| 112 | 0 | 0 | |

4. *Anſ.*

| lb. | oz. | dr. | d. p. lb. |
|---|---|---|---|
| 37 | 5 | $5\frac{4}{12}$ | at 8 |
| 9 | 5 | $5\frac{4}{12}$ | 6 |
| 37 | 5 | $5\frac{4}{12}$ | 4 |
| 28 | 0 | 0 | 2 |
| 112 | 0 | 0 | |

5. *Anſ.*

| lb | oz. | dr. | d. p. lb. |
|---|---|---|---|
| 11 | 3 | $3\frac{2}{10}$ | at 8 |
| 44 | 12 | $12\frac{8}{10}$ | 6 |
| 44 | 12 | $12\frac{8}{10}$ | 4 |
| 11 | 3 | $3\frac{2}{10}$ | 2 |
| 112 | 0 | 0 | |

6. *Anſ.*

| lb. | d. p. lb. |
|---|---|
| 32 | at 8 |
| 24 | 6 |
| 24 | 4 |
| 32 | 2 |
| 112 | |

7 *Anſ.* 28 *lb. of each ſort.*

2. A vintner hath 4 ſorts of wine, *viz.* Canary at 10*s. per* gallon, Malaga at 8s. Rheniſh at 6s. and Oporto at 4s. and he is minded to make a compoſition of 60 gallons, worth 9s. *per* gallon;—I demand how much of each ſort he muſt have?

*Anſ. 45 gallons of Canary, and 5 gal of each other ſort.*

3. A brewer hath 3 ſorts of ale, *viz.* at 10d. at 8d. and at 6d *per* gallon; and he would have a compoſition of 30 gallons, worth 7d. *per* gallon;—I demand how much of each ſort muſt he have?

*Anſ.*
Gals. d. *per* gallon.
5 at 10
5 — 8
20 — 6
—
30
—

4. A goldſmith hath ſeveral ſorts of gold, *viz.* ſome of 24 carats fine, ſome of 22 carats, and ſome of 18 carats fine; and he would have compounded of theſe ſorts the quantity of 60 oz. of 20 carats fine; —I demand how much of each ſort he muſt take?

*Anſ.*
Oz.
12 at 24 carats fine.
12 — 22 ——— ——.
36 — 18 ——— ——
—
60
—

5. A goldſmith had gold of three ſorts, *viz.* of 22 carats, of 21 carats, and of 20 carats ſine, and he would mix with theſe ſo much alloy, as that the quantity of 21 oz. may bear 18 carats fine;—I demand how much of each ſort he muſt take, and how much alloy?

*Anſ. 6 oz. of each ſort of gold, and 3 oz. of alloy.*

6. A druggiſt had three ſorts of drugs, one was worth 4s. *per* lb. another 5s. and another 8s. and out of theſe he made two parcels, one was 21lb. at 6s. *per* lb. and the other 35lb. at 7s. *per* lb. how much of every ſort did he take for each parcel?

*Anſ.*

| lb. | s. *per* lb. | lb. | s. *per* lb. |
|---|---|---|---|
| 6 at | 4 | 5 at | 4 |
| 6 | 5 | 5 | 5 |
| 9 | 8 | 25 | 8 |
| — | | — | |
| 21 | 6s. *per* lb. | 35 | 7s. *per* lb. |
| — | | — | |

## OF POSITION.

Q. WHAT is Poſition, or Negative Arithmetic?

A. It diſcovers the truth by ſuppoſed numbers.

Q. How many kinds of Poſition are there?

A. Two: Single and Double.

### *Of Single Poſition.*

Q. What is Single Poſition?

A. It diſcovers the truth by only one ſuppoſed number.

Q. How is that ſuppoſed number uſed?

A. By working with it, as if it was the true number, in the ſame proportion as the queſtion directs; and if the reſult be either too much or too little, the true number may be found out by the following rule, *viz.*

As the reſult of the poſition,
Is to the poſition:
So is the given number,
To the number required.

Q. How do you prove Poſition?

A. Poſition, both Single and Double, is proved by adding the ſeveral ſums required, or the ſeveral parts of the ſum required together; and if that ſum agrees with the given ſum it is right.

### EXAMPLES.

1. Two men, A and B, having found a bag of money, diſputed who ſhould have it; A ſaid the half, third and fourth of the money made 130l and if B could tell how much was in it, he ſhould have it all, otherwiſe he ſhould have nothing, I demand how much was in the bag? *Anſ.* £120.

2. A, B, and C, determining to buy together a certain quantity of timber, worth 36l. agree that B ſhall pay $\frac{1}{3}$ more than A, and C $\frac{1}{4}$ more than B; I demand how much each man muſt pay? *Anſ. A 9l. B 12l. C 15l.*

3. A perſon having about him a certain number of crowns, ſaid if the half, third, and fourth of them were added together, they would make 65 crowns; I demand how many he had? *Anſ.* 60 *crowns.*

4. A lent B a ſum of money, to be paid at four payments; when three of them were made, and A came to demand the fourth, B would give him no more, except he would tell him how much was paid already: A ſaid the firſt payment was a fourth; the ſecond, a fifth; and the third, a ſixth of the ſum firſt lent, and altogether made 74l. I demand the ſum lent? *Anſ.* £120.

5. One man carrying a bag of money in his hand, another aſked him, how much was in it: he anſwered he could not tell; but the third, fourth, and fifth of it made 94l—how much was in the bag? *An* £120.

6. I have delivered to a banker a certain ſum of money, to receive of him, after the rate of 6l. *per cent. per annum*; and at the end of ten years, he paid me 500l. for principal and intereſt together;—I demand the ſum delivered to him at firſt? *An.* £312 : 10*s.*

*Note,* This queſtion properly belongs to 5th Caſe of Simple Intereſt.

## *Of Double Poſition.*

Q. What is Double Poſition?

A. It is that which diſcovers the true number ſought, by making uſe of two ſuppoſed numbers.

Q How are thoſe ſuppoſed numbers uſed?

A. 1. by working with them as if they were the true numbers, in the ſame proportion as the queſtion directs.

2. The reſults or errors muſt be placed againſt their poſitions, or ſuppoſed numbers; thus,

| *Poſ* | *Er.* |
|---|---|
| 40 | 28 |
| 36 | 19 |

3. Multiply them croſs-wiſe.

4. If the errors are alike, *i. e.* both greater, or both leſs than the given number, take their difference for a diviſor, and the difference of the products for a dividend.

5. If the errors are unlike, take their ſum for a diviſor and the ſum of the products for a dividend; the quotient thence ariſing will be the anſwer.

### EXAMPLES.

1. A, B, and C, would divide 100l. between them, ſo as that B may have 3l. more than A. and C 4l. more than B; I demand how much each man muſt have?

*An. A* 30*l. B* 33*l. C* 37*l.*

2. A man lying at the point of death, ſaid, He had in a certain coffer 100l. which he bequeathed to 3 of his friends after this manner: The firſt muſt have a certain portion, the ſecond muſt have twice as much as the firſt, wanting 8l. and the third muſt have three times as much as the firſt, wanting 15l—I demand how much each man muſt have?

*An. The firſt* 20*l.* 10*s. Second* 33*l. Third* 46*l.* 10*s.*

3. A, B, and C built an houſe which coſt 100l of which A paid a certain ſum; B paid 10l. more than A; and C paid as much as A and B;—I demand each man's ſhare in that charge? *An. A* 20*l. B* 30*l. C* 50*l.*

4. Three perſons diſcourſed together concerning their ages ſays A, I am 20 years of age; ſays B, I am as old as A, and half C; and ſays C, I am as old as you both; I demand the age of each perſon? *An. A was* 20, *B* 60, *C* 80 *years of age.*

5. A man lying at the point of death, left to his 3 ſons all his eſtate in money, *viz* to F half wanting 50l; to G one third; and to H the reſt, which was 10l. leſs than the ſhare of G;— I demand the ſum left, and each man's part? *An. The ſum left was* 360*l. whereof F had* 130*l. G* 120*l. H* 110*l.*

6. A certain man having drove his ſwine to the market, *viz.* hogs, ſows, and pigs, received for them all 50l. being paid for every hog 18s. for every ſow 16s. for every pig 2s. There were as many hogs as ſows, and for every ſow there were three pigs:—I demand how many there were of each ſort? *An.* 25 *hogs,* 25 *ſows,* 75 *pigs.*

7. A ſurly old fellow being demanded the ages of his four children, anſwered, You may go and look: But if you muſt needs know, my firſt ſon was born juſt one year after I was married to his mother, who after his birth lived 5 years, and then died in child-bed with my ſecond ſon: 4 years after that I married again, and within 2 years had my third and fourth ſons at a birth: the ſum of whoſe two ages is now equal to that of the eldeſt:—I demand their ſeveral ages?

*An. The firſt ſon was* 22 *years old, the ſecond* 17, *the third* 11, *and the fourth* 11 *years old.*

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## OF COMPARATIVE ARITHMETIC.

Q. WHAT is Comparative Arithmetic?

A. It is ſuch as anſwers queſtions by numbers having relation to another.

Q. Wherein does this relation conſiſt?

A. It conſiſts either in quantity or quality.

Q. What is relation of numbers in quantity?

A. It is the reſpect that one number has to another.

Q. How many are the numbers propounded?

A. They are always two, the antecedent and the conſequent.

Q. In what does relation of numbers in quantity conſiſt?

A. It conſiſts in the difference, or elſe in the rate or reaſon that is found between the terms propounded.

*Note,* The difference of any two numbers is the remainder; but the rate or reaſon is the quotient of the antecedent divided by the conſequent.

Q. What is relation of numbers in quality or progreſſion?

A. Progreſſion or proportion is the reſpect that the reaſon of numbers have one to another.

Q. How many muſt the terms be?

A. Three or more, but never leſs: Becauſe leſs than three will not admit of a compariſon of reaſons or differences.

## *Of Progreſſion.*

Q. How many kinds of Progreſſion are there?

A. Two; Arithmetical and Geometrical.

## *Of Arithmetical Progreſſion.*

Q. What is Arithmetical Progreſſion?

A. Arithmetical Progreſſion is when ſeveral numbers have equal differences; as 1, 2, 3, 4, differ by 1; or 2, 4, 6, 8, differ by 2.

Note 1, If any number of terms differ by Arithmetical Progreſſion, the ſum of the two extremes will be equal to the ſum of any two means, equally diſtant from the extremes, As in 2, 4, 6, 8, where $2+8$ are $= 4+6=10$, and ſo of any larger number of terms.

2. If the number of terms be odd, the middlemoſt ſupplies the place of two terms. As in 1, 2, 3; where $1+3$ are $=2+2=4$.

### Caſe I.

Q. What do you obſerve in this firſt caſe?

A. When the two extremes, and the number of terms in any ſeries of numbers in Arithmetical Progreſſion are given, and the ſum of all the terms is required, then multiply the ſum of the two extremes by half the number of terms: Or, multiply half the ſum of the extremes by the whole number of terms, the product is the total of all the terms.

### EXAMPLES.

1. How many ſtrokes does the hammer of a clock ſtrike in 12 hours? *An.* 78.

2. A merchant hath ſold 100 yards of ſuperfine cloth, viz. the firſt yard for 1s. the ſecond for 2s. the third for 3s. *&c.* —I demand how much he received for the ſaid cloth?

*An.* £252 ; 10s.

3. Bought 19 yards of ſhalloon, and gave 1d. for the firſt yard, 3d. for the ſecond, 5d. for the third, &c. increaſing 2d. every yard;—I demand what I gave for the 19 yards?

*An.* £1 : 10 : 1.

4 A mercer ſold 20 yards of ſilk, at 3d. for the firſt yard, 6d. for the ſecond, 9d. for the third, &c. increaſing 3d. every yard;—I demand what he ſold the 20 yards for?

*An.* £2 : 12 : 6.

5. A butcher bought 100 head of cattle, viz. oxen, and gave for the firſt ox 1 crown, for the ſecond ox 2 crowns, for

the third ox 3 crowns, &c.—I demand what the cattle coſt him? *Anſ.* £1262 : 10*s.*

6. Admit 100 ſtones were laid 2 yards diſtant from each other in a right line, and a baſket placed 2 yards from the firſt ſtone;—I demand how many miles a man ſhall go in gathering them ſingly into the baſket?

*An.* 11 *miles*, 3 *furlongs*, 180 *yards.*

7. A merchant ſold 100 yards of linen at 2 pins for the firſt yard, 4 for the ſecond, and 6 for the third, &c. increaſing 2 pins, for every yard;—I demand how much the linen produced, when the pins were afterwards ſold at 12 for a farthing? alſo whether the ſaid merchant gained or loſt by the ſale thereof, and how much, ſuppoſing the ſaid linen to have been bought at 6d. *per* yard?

| | | |
|---|---|---|
| *An.* | *The linen produced* | £86 : 17 : 10 |
| | *The merchant gained* | 61 : 17 : 10 |

### Caſe II.

Q. What do you obſerve in the ſecond Caſe?

A. When the two extremes, and the number of terms in any ſeries of numbers in Arithmetical Progreſſion are given, and the common difference of all the terms in that ſeries are required, then,

Divide the difference between the two extremes by the number of terms leſs one; the quotient will be the common difference.

### EXAMPLES.

1. There are 21 men, whoſe ages are equally diſtant from each other in Arithmetical Progreſſion; the youngeſt is 20 years old, and the eldeſt is 60:—I demand the common difference of their ages, and the age of each man;

*An. The common difference is two years; therefore,*

Years.

60 is the age of the firſt man,

60 — 2 = 58 is the age of the ſecond,

58 — 2 = 56 is the age of the third,

56 — 2 = 54 is the age of the fourth, &c.

2. A debt is to be diſcharged at 16 ſeveral payments in Arithmetical Proportion; the firſt payment is to be 14l. the laſt 100l what is the whole debt, and what muſt each payment be? *An. The whole debt is* 912*l. The common difference is* £ 5 : 14 : 8; *therefore,*

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | = | 14l. | 0s | 0d. | 1ſt payment. |
| 14l. | 0s. | 0d. | + | 5l. | 14s. | 8d. | = | 19 | 14 | 8 | 2d. |
| 19 | 14 | 8 | + | 5 | 14 | 8 | = | 25 | 9 | 4 | 3d. |
| 25 | 9 | 4 | + | 5 | 14 | 8 | = | 31 | 4 | 0 | 4th, &c. |

3. A man is to travel from York to a certain place in 12 days, and go but 3 miles the firſt day, increaſing every day's journey by an equal exceſs, ſo that the laſt day's journey may be 36 miles;—what will each day's journey be, and how many miles is the place he goes to diſtant from York?

*Anſ. The common difference is 3; therefore,*

Miles.
3 is the firſt day's journey,
3 + 3 = 6 is the ſecond,
6 + 3 = 9 is the third,
9 + 3 = 12 is the fourth, &c.
The whole diſtance is 234 miles.

4. A running footman, on a wager, is to travel from London northward, as follows: that is to ſay, he is to go 4 miles the firſt day; and 40 miles the laſt day; and to go the whole journey in 10 days, increaſing every day's journey by an equal exceſs;—I demand the number of miles he travelled each day, and the length of the whole journey?

*Anſ. The common difference 4; therefore,*

Miles.
4 is the firſt day's journey,
4 + 4 = 8 is the ſecond,
8 + 4 = 12 is the third, &c.
The whole journey is 220 miles.

## *Of Geometrical Progreſſion.*

Q. What is Geometrical Progreſſion?

A. When any rank or ſeries of numbers increaſe by one common multiplier, or decreaſe by one common diviſor, thoſe numbers are continued in Geometrical Progreſſion; as 3, 6, 12, 24, increaſe by the multiplier 2; and 24, 12, 6, 3, decreaſe by the diviſor 2.

*Note*, 1. If any number of terms be continued in Geometrical Progreſſion, the product of the two extremes will be equal to the product of any two means equally diſtant from the extremes, as in 3, 6, 12, 24; where $3 \times 24$, are $= 6 \times 12 = 72$; and ſo of any larger number of terms.

2. If the number of terms be odd, the middlemoſt ſupplies the place of two terms; as in 3, 6, 12, where $3 \times 12$ are $= 6 \times 6 = 36$.

3. The common multiplier, and the common diviſor, are called ratios.

Q. How is the ſum of any ſeries in Geometrical Progreſſion obtained?

A. 1. When all the terms alone are given, then from the product of the ſecond and laſt terms, ſubtract the ſquare of the firſt term; that remainder being divided by the ſecond term leſs the firſt will give the ſum of all the terms.

2. When the two extremes and the ratio are only given, then multiply the laſt term into the ratio, and from that product ſubtract the firſt term: that remainder divide by the ratio leſs an unit or 1, the quotient is the ſum of all the terms.

*Note*, 1. As the laſt term in a long ſeries of numbers is very tedious to come at by continual multiplication; it would be neceſſary for the readier finding it out to have a ſeries of numbers in Arithmetical Proportion, called indices, beginning with an unit, whoſe common difference is one: Alſo whatſoever number of indices you make choice of, let as many numbers (in ſuch Geometrical Proportion as are given in the queſtion) be placed under them.

Thus, { 1, 2, 3, 4, 5, 6, 7, indices,
{ 2, 4, 8, 16, 32, 64 128, numbers in Geometrical Proportion.

2. But if the firſt term in Geometrical Proportion be different from the ratio, the indices muſt begin with a cypher.

Thus, { 0, 1, 2, 3, 4, 5, 6, indices,
{ 1, 2, 4, 8, 16, 32, 64, numbers in Geometrical Proportion.

3. When the indices begin with a cypher, the ſum of the indices made choice of, muſt always be one leſs than the number of terms given in the queſtion; becauſe 1 in the indices ſtands over the ſecond term, and 2 in the indices ſtands over the third term, &c.

4. Add any two of theſe indices together, and that ſum will directly correſpond with the product of their reſpective terms.

5. By the help of theſe indices, and a few of the firſt terms, in any ſeries of Geometrical Progreſſion, any term whoſe diſtance from the firſt term is aſſigned, though it were never ſo far, may ſpeedily be obtained, without producing all the terms.

## EXAMPLES.

1. A man bought a horſe, and by agreement was to give a farthing for the firſt nail, two for the ſecond, four for the third, &c. there were 4 ſhoes, and 8 nails in each ſhoe:—I demand what the horſe was worth at that rate?

*Anſ.* £4473924 : 5 : 3 : 3 *qrs.*

2. A merchant ſold 15 yards of ſatin, the firſt yard for 1s. the ſecond for 2s. the third for 4s. the fourth for 8s. &c.—I demand the price of the 15 yards? *Anſ.* £1638 : 7*s.*

3. A draper ſold 20 yards of ſuperfine cloth, the firſt yard for 3d. the ſecond for 9d. the third for 27d. &c. in triple Proportion Geometrical;—I demand the price of the cloth?

*Anſ.* £21792402 : 10*s.*

4 A goldſmith ſold 1 lb. of gold, at a farthing for the firſt ounce, a penny for the ſecond, 4d. for the third. &c. in quadruple proportion geometrical ;—I demand what he ſold the whole for ; alſo how much he gained by the ſale ; therefore ſuppoſing he gave for it 4l. *per* ounce ?

*Anſ.* { He ſold it for £5825 : 8 : 5 : 1 *qr.*
And gained 5777 : 8 : 5 : 1

5. A crafty ſervant agreed with a farmer (ignorant in numbers) to ſerve him 12 years, and to have nothing for his ſervice but the produce of a wheat corn for the firſt year ; and that product to be ſowed for the ſecond year : and ſo on from year to year, until the end of the ſaid time ;—I demand his wages ſuppoſing the increaſe to be but in a tenfold proportion and ſold out at 4s. *per* buſhel ? *Anſ.* £452112 : 4s. *rejecting remainders.*

*Note* 1, 7680 wheat or barley-corns are ſuppoſed to make a pint, and 64 pints a buſhel.

2, If the firſt term in any ſeries be either greater or leſs than the ratio, (except unity) then multiply any two terms together, and their product divide by the firſt term ; that quotient will exactly correſpond with the ſum of their indices.

6. A threſher worked 20 days at a farmer's, and received for the firſt day's work, 4 barley-corns ; for the ſecond, 12 barley-corns ; for the third, 36 barley-corns ; and ſo on in triple proportion geometrical ;—I demand what the 20 days labour came to, ſuppoſing the whole quantity to be ſold for 2s. 6d. *per* buſhel? *Anſ.* £1773 : 7 : 6 *rejecting remainders.*

7. A merchant ſold 30 yards of fine velvet, trimmed with gold very curiouſly, at 2 pins for the firſt yard, 6 pins for the ſecond, 18 pins for the third, &c. in triple proportion geometrical ;—I demand how much the velvet produced, when the pins were afterwards ſold at 100 for a farthing ; alſo whether the ſaid merchant gained or loſt by the ſale thereof, and how much, ſuppoſing the ſaid velvet to have been bought at 50l *per* yard?

*Anſ.* { The velvet produced £2144699292 : 13 : 0½.
The merchant gained 2144697792 : 13 : 0½.

## OF PERMUTATION.

Q. WHAT is Permutation ?

A. Changing the order of things.

Q. How do you find all the variations any number of things is capable of going through ?

A. Multiply all the given terms one into another continually ; the laſt product is the number of changes required.

## EXAMPLES.

1. I demand how many changes may be rung upon twelve bells; and alſo how long they would be in ringing but once over, ſuppoſing 24 changes might be rung in one minute, and the year to contain 365 days, 6 hours?

*Anſ. The number of changes is* 479001600, *and the time is* 37 *years,* 49 *weeks,* 2 *days,* 18 *hours.*

2. Seven gentlemen, who were travelling, met together by chance, at a certain inn upon the road, where they were ſo well pleaſed with their hoſt, and each others company, that in a frolic, they offered him 30l. to ſtay at that place ſo long as they, together with him, could ſit every day at dinner in a different order: The hoſt thinking that they could not ſit in many different poſitions becauſe they were but few of them, and that himſelf would make no conſiderable alteration, he being but one, imagined that he ſhould make a good bargain; and readily (for the ſake of a good dinner and better company) entered into an agreement with them, and ſo made himſelf the eighth perſon;—I demand how long they ſtaid at the ſaid inn, and how many different poſitions they ſat in?

*Anſ. The number of poſitions were* 40320; *and the time that they ſtaid was* 110 *years,* 142 *days; allowing the year to conſiſt of* 365 *days,* 6 *hours.*

*Note*, There is one thing in Progreſſion, and in varying the order of things, which is well worth our obſervation; and that is, the power of numbers, which is ſurpriſingly great, and beyond common belief; and is no ways conceivable by a common practitioner, hardly by a very good artiſt; it being (in appearance) not ſo much againſt reaſon as above it. The firſt example in geometrical progreſſion diſcovers what a prodigious ſum of money a horſe ſold after that manner would produce, viz. no leſs than four million, four hundred and ſeventy three thouſand nine hundred and twenty four pounds; whereas if the ſame horſe had been ſold at the ſame rate and but a fourth part of the nails, he would have brought to his owner no more than 5s. $3\frac{3}{4}$d. The ſecond example in Permutation, does likewiſe diſcover the impoſſibility of the inn-keeper's performing his promiſe; and in both, the ſimplicity of two men, who thinking they have got very good bargains, do inſtead thereof find themſelves ſevere ſufferers. And although at the firſt appearance, each queſtion ſeems to produce but a mere trifle; yet upon a mature conſideration, there would not be found a man in the kingdom able to purchaſe the one, or long lived enough to ſtand to the agreement with the other. Hence obſerve the great poſſibility of a man's being impoſed on in this way by ſharpers, without a careful examination into the affair, before any contract is made.

THE

# SCHOOLMASTER'S ASSISTANT.

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## PART II.

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## OF VULGAR FRACTIONS.

### *Of Fractions in general.*

Q. WHAT is a Fraction?

*A.* It is a broken number, and ſignifies the part or parts of a whole number.

Q. How many kinds of Fractions are there?

A. Two: Vulgar and Decimal.

### *Of Notation of Vulgar Fractions.*

Q What is a Vulgar Fraction?

*A.* Any two numbers placed thus $\frac{7}{8}$ make a Vulgar Fraction.

Q. What is the upper number of ſuch a fraction called?

A. It is called Numerator, and is the remainder after diviſion.

Q. What is the lower number called?

A. It is called Denominator, and denotes any whole divided into parts: and is the diviſor in diviſion.

Q. How many ſorts of Vulgar Fractions are there?

A. Three: Proper, improper, and compound.

Q. What is a proper Fraction?

A. When the numerator is leſs than the denominator, as $\frac{7}{8}$,

Q. How far may a proper Fraction be expreſſed?

A. Without end; as $\frac{1}{2}$ may be called $\frac{2}{4}$ or $\frac{3}{6}$ or $\frac{4}{8}$, &c. but the loweſt term $\frac{1}{2}$ is always deſired.

Q. What is an improper Fraction?

A. When the numerator is greater than the denominator as $\frac{8}{7}$.

Q. What is a Compound Fraction?

A. It is the Fraction of a Fraction, as $\frac{1}{2}$ of $\frac{2}{3}$, &c.

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### *Of Reduction of Vulgar Fractions.*

#### Caſe I.

Q. HOW are Vulgar Fractions reduced to a common denominator?

A. 1. Multiply each numerator into all the denominators but its own, for a new numerator.

2. Multiply all the denominators for a common denominator.

### Examples.

1. Reduce $\frac{3}{6}$ and $\frac{5}{8}$ to a common denominator.
*Facit* $\frac{24}{48}$ and $\frac{30}{48}$.
2. Reduce $\frac{7}{8}$, $\frac{9}{10}$, and $\frac{11}{12}$, to a common denominator.
*Facit* $\frac{840}{960}$, $\frac{864}{960}$, and $\frac{880}{960}$.
3. Reduce $\frac{6}{10}$, $\frac{4}{8}$, $\frac{1}{9}$, and $\frac{6}{7}$, to a common denominator.
*Facit* $\frac{3024}{5040}$, $\frac{2520}{5040}$, $\frac{560}{5040}$, and $\frac{4320}{5040}$.
4. Reduce $\frac{4}{9}$, $\frac{7}{12}$, $\frac{6}{7}$, and $\frac{1}{2}$ to a common denominator.
*Facit* $\frac{616}{1386}$, $\frac{882}{1386}$, $\frac{1188}{1386}$, and $\frac{693}{1386}$.
5. Reduce $\frac{6}{9}$, $\frac{2}{7}$, $\frac{1}{3}$, and $\frac{7}{8}$ to a common denominator.
*Facit* $\frac{1008}{1512}$, $\frac{432}{1512}$, $\frac{504}{1512}$, and $\frac{1323}{1512}$.
6. Reduce $\frac{4}{5}$, $\frac{1}{2}$, $\frac{5}{6}$, and $\frac{2}{8}$ to a common denominator.
*Facit* $\frac{384}{480}$, $\frac{240}{480}$, $\frac{400}{480}$, and $\frac{120}{480}$.

### CASE II.

Q. How do you reduce a Vulgar Fraction to its loweſt term?

A. 1. Find a common Meaſure by dividing the lower term by the upper; and that diviſor by the remainder following, till nothing remains: the laſt diviſor is the common meaſure.

2. Divide both parts of the fraction by the common meaſure, and the quotients will make the fraction required.

*Note* 1. If the common meaſure happens to be 1, the given fraction is already in its loweſt terms.
2. When a fraction hath cyphers at the right hand, it may be abbreviated by cutting them off; thus $\frac{7|0}{9|0}$.
3. This Caſe will prove Caſe 1.

### EXAMPLES.

1. Reduce $\frac{48}{56}$ to its loweſt terms. *Facit* $\frac{6}{7}$.
2. Reduce $\frac{72}{94}$ to its loweſt terms. *Facit* $\frac{36}{47}$.
3. Reduce $\frac{84}{170}$ to its loweſt terms. *Facit* $\frac{42}{85}$.
4. Reduce $\frac{60}{125}$ to its loweſt terms. *Facit* $\frac{12}{25}$.
5. Reduce $\frac{182}{196}$ to its loweſt terms. *Facit* $\frac{13}{14}$.
6. Reduce $\frac{468}{1184}$ to its loweſt terms. *Facit* $\frac{117}{296}$.

### CASE III.

Q. What is a mixt number?

A. It is compoſed of a whole number and a fraction thus $7\frac{3}{4}$.

Q. How is a mixt number reduced to an improper fraction?

A. 1. Multiply the whole number into the denominator of the fraction.

2. To the product add the numerator for a new numerator.

3. Let its denominator, be the denominator given.

*Note*, To expreſs a whole number fraction-wiſe, put 1 for its denominator.

### EXAMPLES.

1. Reduce $12\frac{15}{17}$ to an improper fraction. *Facit* $\frac{219}{17}$.
2. Reduce $19\frac{12}{18}$ to an improper fraction. *Facit* $\frac{354}{18}$.
3. Reduce $16\frac{18}{100}$ to an improper fraction. *Facit* $\frac{1618}{100}$.
4. Reduce $12\frac{19}{56}$ to an improper fraction. *Facit* $\frac{691}{56}$.
5. Reduce $100\frac{19}{59}$ to an improper fraction. *Facit* $\frac{5910}{59}$.
6. Reduce $79\frac{12}{19}$ to an improper fraction. *Facit* $\frac{1513}{19}$.

## Caſe IV.

Q. How is an improper fraction reduced to its proper terms?
A. Divide the upper term by the lower.

*Note*, This Caſe and Caſe 3, prove each other,

### EXAMPLES.

1. Reduce $\frac{218}{17}$ to its proper terms. *Facit* $12\frac{15}{17}$.
2. Reduce $\frac{141}{17}$ to its proper terms. *Facit* $8\frac{5}{17}$.
3. Reduce $\frac{126}{48}$ to its proper terms. *Facit* $2\frac{30}{48}$.
4. Reduce $\frac{971}{17}$ to its proper terms. *Facit* $56\frac{9}{17}$.
5. Reduce $\frac{13}{7}$ to its proper terms. *Facit* $1\frac{6}{7}$.
6. Reduce $\frac{24}{7}$ to its proper terms. *Facit* $3\frac{3}{7}$.

## CASE V.

Q. How do you reduce a compound fraction to a ſingle one?
A. 1. Multiply all the numerators for a new numerator.
2. Multiply all the denominators for a new denominator.

### EXAMPLES.

1. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a ſingle fraction. *Facit* $\frac{6}{24}$.
2. Reduce $\frac{7}{8}$ of $\frac{4}{6}$ of $\frac{9}{10}$ to a ſingle fraction. *Facit* $\frac{252}{480}$.
3. Reduce $\frac{12}{14}$ of $\frac{5}{6}$ of $\frac{1}{2}$ to a ſingle fraction. *Facit* $\frac{60}{168}$.
4. Reduce $\frac{5}{9}$ of $\frac{4}{8}$ of $\frac{3}{4}$ to a ſingle fraction. *Facit* $\frac{60}{288}$.
5. Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ to a ſingle fraction. *Facit* $\frac{24}{60}$.
6. Reduce $\frac{1}{2}$ of $\frac{8}{9}$ of $\frac{6}{7}$ to a ſingle fraction. *Facit* $\frac{48}{126}$.

## Caſe VI.

Q. How do you reduce the fraction of one denomination to the fraction of another, but greater, retaining the ſame value?

A. 1. Reduce the given fraction to a compound fraction, by comparing it with all the denominations between it, and that denomination, which you would reduce it to.

2. Reduce that compound fraction to a ſingle one, by caſe 5.

### Examples.

1. Reduce $\frac{5}{6}$ of a penny to the fraction of a pound. *Facit* $\frac{5}{1440}$*l*

2. Reduce $\frac{1}{2}$ of a farthing to the fraction of a ſhilling. *Facit* $\frac{1}{96}$*s.*

3. Reduce $\frac{8}{9}$ of an ounce Troy to the fraction of a pound. *Facit* $\frac{8}{108}$*lb.*

4. Reduce $\frac{6}{7}$ of a pound Avoirdupois to the fraction of a cwt. *Facit* $\frac{6}{784}$ *cwt.*

5. Reduce $\frac{9}{13}$ of a pint of wine to the fraction of a hhd. *Facit* $\frac{9}{6552}$ *hhd.*

### Caſe VII.

Q. How do you reduce the fraction of one denomination to the fraction of another, but leſs, retaining the ſame value?

A. Multiply the given numerator, by the parts of the denominations between it, and that denomination you would reduce the fraction to for a new numerator, and place it over the given denominator.

*Note,* This Caſe and Caſe 6, prove each other.

### Examples.

1. Reduce $\frac{5}{1440}$ of a pound to the fraction of a penny. *Facit* $\frac{1200}{1440}=\frac{5}{6}$*d.*

2. Reduce $\frac{1}{96}$ of a ſhil. to the fraction of a farthing. *Facit* $\frac{1}{2}$*qr.*

3. Reduce $\frac{8}{108}$ of a lb. Troy to the fraction of an oz. *Facit* $\frac{8}{9}$*oz.*

4. Reduce $\frac{6}{784}$ of a cwt. to the fraction of a lb. *Facit* $\frac{6}{7}$*lb.*

5. Reduce $\frac{9}{6552}$ of a hhd. of wine to the fraction of a pint. *Facit* $\frac{9}{13}$ *pint.*

### Caſe VIII.

Q. How do you reduce vulgar fractions from one denomination to another of the ſame value, having the numerator of the required fraction given?

A. As the numerator of the given fraction,
Is to its denominator:
So is the numerator of the intended fraction,
To its denominator.

### *Examples.*

1. Reduce $\frac{3}{4}$ to a fraction of the ſame value whoſe numerator ſhall be 15 *Facit* $\frac{15}{20}=\frac{3}{4}$.

2. Reduce $\frac{7}{8}$ to a fraction of the ſame value, whoſe numerator ſhall be 42. *Facit* $\frac{42}{48}$.

3. Reduce $\frac{3}{4}$ to a fraction of the ſame value, whoſe numerator ſhall be 34. *Facit* $\frac{34}{46}\frac{1}{2}$.

4. Reduce $\frac{5}{9}$ to a fraction of the ſame value, whoſe numerator ſhall be 73. *Facit* $\frac{73}{131}\frac{2}{5}$.

Note, From Caſes 8 and 9, there ariſes a new fraction which may not improperly be called a mixt fraction.

### CASE IX.

Q. How do you reduce vulgar fractionsfrom one denomination to another of the ſame value, having the denominator of the required fraction given ?

A. As the denominator of the given fraction,
Is to its numerator :
So is the denominator of the intended fraction,
To its numerator.

*Note,* This caſe and caſe 8 prove each other.

### EXAMPLES.

1. Reduce $\frac{3}{4}$ to a fraction of the ſame value, whoſe denominator ſhall be 20. *Facit* $\frac{15}{20}=\frac{3}{4}$.

2. Reduce $\frac{7}{8}$ to a fraction of the ſame value, whoſe denominator ſhall be 49. *Facit* $\frac{42}{49}\frac{7}{8}$

3. Reduce $\frac{3}{4}$ to a fraction of the ſame value, whoſe denominator ſhall be 46. *Facit* $\frac{34}{46}\frac{1}{2}$

4. Reduce $\frac{5}{9}$ to a fraction of the ſame value, whoſe denominator ſhall be 131 $\frac{2}{5}$. *Facit* $\frac{73}{131}$, $\frac{2}{5}$.

### CASE X.

Q. How is a mixt fraction reduced to a ſingle one ?

A. 1. When the numerator is the integral part : Then,

(1.) Multiply it by the denominator of the fractional part, and to that product add the numerator of the fractional part, for a new numerator.

(2.) Multiply the denominator of the fraction by the denominator of the fractional part of the numerator, for a new denominator.

*Note,* This proves caſe 9.

### EXAMPLES.

1. Reduce $\frac{42}{49}\frac{7}{8}$ to a ſimple fraction. *Facit* $\frac{7}{8}$.
2. Reduce $\frac{34}{46}\frac{1}{2}$ to a ſimple fraction. *Facit* $\frac{3}{4}$.
3. Reduce $\frac{17}{43}\frac{4}{9}$ to a ſimple fraction. *Facit* $\frac{157}{387}$.

2. When the denominator is in the integral part : Then

(1) Multiply it by the denominator of the fractional part and to that product add the numerator of the fractional part for a new denominator.

(2) Multiply the numerator of the fraction by the denominator of the fractional part, for a new numerator.

*Note.* This proves caſe 8.

### EXAMPLES.

1. Reduce $\frac{73}{131}\frac{2}{5}$ to a ſimple fraction. *Facit* $\frac{365}{658}=\frac{5}{9}$
2. Reduce $\frac{41}{73}\frac{1}{4}$ to a ſimple fraction. *Facit* $\frac{164}{293}$
3. Reduce $\frac{7}{19}\frac{3}{5}$ to a ſimple fraction *Facit* $\frac{35}{98}=\frac{5}{14}$

## CASE XI.

Q. How do you find the proper quantity of a fraction in the known parts of an integer?

A. Multiply the numerator by the common parts of the integer, and divide by the denominator.

### EXAMPLES.

1. Reduce $\frac{2}{3}$ of a pound ſterling to its proper quantity.
*Facit* 13*s.* 4*d.*

2. Reduce $\frac{18}{43}$ of a ſhilling to its proper quantity. *Facit* 5 $\frac{1}{43}$*d*

3. Reduce $\frac{6}{7}$ of 5l. 9s. to its proper quantity.
*Facit* £4 : 13 : 5$\frac{1}{7}$.

4 Reduce $\frac{12}{16}$ of a lb. Troy to its proper quantity. *Facit* 9 *oz.*

5. Reduce $\frac{12}{78}$ of a ton weight to its proper quantity.
*Facit* 3 *cwt.* 8 *lb.* 9 *oz.* 13 *dr.* $\frac{42}{78}$.

6. Reduce $\frac{5}{9}$ of a lb. avoirdupois to its proper quantity.
*Facit* 8 *oz.* 14 *dr* $\frac{2}{9}$.

7. Reduce $\frac{9}{11}$ of 10 cwt. 1 *qr.* 12*lb.* to its proper quantity.
*Facit* 8 *cwt.* 1 *qr.* 25 *lb* 1 *oz.* 7 *dr.* $\frac{3}{11}$.

8. Reduce $\frac{4}{7}$ of a mile to its proper quantity.
*Facit* 4 *fur.* 125 *yds.* 2 *feet.* 1 *in.* 2 *b. c.* $\frac{1}{7}$.

9. Reduce $\frac{9}{10}$ of a yard to its proper quantity.
*Facit* 2 *feet* 8 *in.* 1 *b. c.* $\frac{2}{10}$.

10. Reduce $\frac{4}{5}$ of an ell Engliſh to its proper quantity.
*Facit* 1 *yard.*

11. Reduce $\frac{7}{10}$ of an acre to its proper quantity.
*Facit* 1 *rood,* 30 *perches.*

12. Reduce $\frac{4}{9}$ of a tun of wine to its proper quantity.
*Facit* 1 *hhd.* 49 *gal.*

13. Reduce $\frac{7}{8}$ of a barrel of beer to its proper quantity.
*Facit* 31 *gals.* $\frac{1}{2}$.

14. Reduce $\frac{3}{8}$ of a chaldron of coals to its proper quantity.
*Facit* 13 *buſh.* $\frac{1}{2}$.

15. Reduce $\frac{2}{7}$ of a quarter of corn to its proper quantity.
*Facit* 2 *buſh.* 1 $\frac{1}{7}$ *peck.*

16. Reduce $\frac{7}{15}$ of a day natural to its proper quantity.
*Facit* 12 *hours* 55 *min.* 23 *ſec.* $\frac{1}{15}$.

17. Reduce $\frac{4}{5}$ of a month to its proper quantity.
*Facit* 3 *weeks,* 1 *day,* 9 *hrs,* 36 *min.*

18. What is the proper quantity of $\frac{7}{8}$ of a yard of cloth.
*Anſ* 3 *qrs.* 2 *na.*

19. What is the proper quantity of $\frac{2}{9}$ of a *hhd.* of beer?
*Anſ.* 12 *gal.*

20. What is the proper quantity of $\frac{3}{10}$ of a barrel of ale?
*Anſ.* 6 *gals.*

### CASE XII.

Q. How do you reduce any given quantity to the fraction of any greater denomination of the ſame kind?

A. 1. Reduce the given quantity to the loweſt term mentioned for a numerator.

2. Reduce the integral part to the ſame term for a denominator, and that will be the fraction required.

*Note,* 1. If there be a fraction given with the ſaid quantity, let it be put to the numerator of the fraction required.

2 Caſes 11 and 12 prove each other.

### EXAMPLES.

1. Reduce 13s. 4d. to the fraction of a pound ſterling. *Facit* $\frac{160}{240}=\frac{2}{3}$*l.*

2. Reduce $5\frac{1}{43}$. to the fraction of a ſhilling. *Facit* $\frac{18}{43}$*s.*

3. What part of 5l 9s. is 4l. 13s. $5\frac{1}{7}$d? *Anſ.* $\frac{6}{7}$.

4. Reduce 9 oz. Troy to the fraction of a lb. *Facit* $\frac{9}{12}=\frac{3}{4}$*lb*

5 Reduce 3 cwt. 8 lb. 9 oz. 13 dr. $\frac{42}{78}$ to the fraction of a ton. *Facit* $\frac{12}{78}$ *ton.*

6. Reduce 8 oz. 14 dr $\frac{2}{9}$ to the fraction of a lb. avoirdupois. *Facit* $\frac{5}{9}$ *lb.*

7. What part of 10 cwt. 1 qr. 12 lb. is 8 cwt. 1 qr. 25lb. 1 oz. $7\frac{3}{11}$ dr.? *Anſ* $\frac{6}{11}$.

8 Reduce 4 fur. 125 yds. 2 feet, 1 in. 2 b. c. $\frac{1}{7}$ to the fraction of a mile. *Facit* $\frac{4}{7}$ *mile.*

9. Reduce 2 feet, 8 in. 1 b. c. $\frac{2}{10}$ to the fraction of a yard *Facit* $\frac{9}{10}$ *yard.*

10. Reduce 1 yard to the fraction of an ell. *Facit* $\frac{4}{5}$ *ell.*

11. Reduce 1 rood, 30 poles, to the fraction of an acre. *Facit* $\frac{7}{16}$ *acre.*

12. Reduce 1 hhd 49 gals. of wine to the fraction of a tun. *Facit* $\frac{4}{9}$ *tun.*

13. Reduce $31\frac{1}{2}$ gals. of beer to the fraction of a barrel. *Facit* $\frac{7}{8}$ *barrel.*

14. Reduce $13\frac{1}{2}$ buſh. of coals to the fraction of a chaldron. *Facit* $\frac{3}{8}$ *chaldron.*

15. Reduce 2 buſh. 1 peck $\frac{1}{7}$ of corn to the fraction of a quarter. *Facit* $\frac{2}{7}$ *quarter.*

16. Reduce 12 hrs 55 min. $23\frac{1}{13}$ ſec. to the fraction of a day natural. *Facit* $\frac{7}{13}$ *day.*

17. Reduce 3 w. 1d. 9 hrs. 36 min. to the fraction of a month. *Facit* $\frac{4}{5}$ *month.*

18. Reduce 3 qrs. 2 na. to the fraction of a yard. *Facit* $\frac{7}{8}$ *yard.*

19. Reduce 12 gals. of beer to the fraction of a hhd. *Facit* $\frac{2}{9}$ *hhd.*

20. Reduce 6 gals. of ale to the fraction of a barrel. *Facit* $\frac{3}{16}$ *bar.*

21. Reduce 13 hours 30 min. to the fraction of a day. *Facit* $\frac{810}{1440}=\frac{9}{16}$.

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## Of ADDITION of VULGAR FRACTIONS.

Q. HOW are Vulgar Fractions added together?

A. 1. Reduce the given fractions to a common denominator.

2. Add all the numerators together for a new numerator; under which ſubſcribe the common denominator.

Note, This rule is proved by Subtraction, when 2 fractions only are given.

### Examples.

1. Add $\frac{1}{2}$ and $\frac{7}{8}$ together, - - - *Facit* $1\frac{6}{16}$.
2. Add $\frac{7}{10}$ and $\frac{11}{12}$ $\frac{4}{9}$ together, - - *Facit* $2\frac{66}{1080}$.
3. Add 19 and $7\frac{1}{2}$ of $\frac{2}{3}$ together, - *Facit* $26\frac{2}{6}$.
4. Add $\frac{1}{2}$ of $\frac{7}{8}$ and $\frac{2}{3}$ of $\frac{19}{10}$ together, - *Facit* $1\frac{68}{960}$.
5. Add $\frac{1}{3}$ of 95 and $\frac{7}{8}$ of 14 together, *Facit* $43\frac{22}{24}$.
6. Add $\frac{2}{3}$ and $17\frac{1}{2}$ together, - - *Facit* $18\frac{1}{6}$.
7. Add $12\frac{1}{2}$ and $3\frac{2}{3}$ and $4\frac{3}{4}$ together - *Facit* $20\frac{22}{24}$.
8. Add $6\frac{7}{8}$ of $\frac{9}{10}$ and $\frac{4}{7}$ of $\frac{1}{2}$ and $7\frac{1}{2}$ together, *Facit* $14\frac{1284}{2240}$.

Note, In order to find the following Facits, the fractions given muſt be reduced to their proper quantities by Caſe 11, in Reduction, and then added, as in Addition of whole numbers.

9. Add $\frac{7}{8}$ of a pound to $\frac{3}{4}$ of a ſhilling, *Facit* 18*s.* 3*d.*

10 Add $\frac{3}{4}$ of a penny to $\frac{1}{9}$ of a pound, *Facit* 2*s.* 3*d.* 1 *qr.* $\frac{6}{9}$.

11. Add $\frac{1}{2}$ of a lb. Troy to $\frac{7}{12}$ of an oz. *Facit* 6 *oz.* 11 *dwts.* 16 *gr.*

12. Add $\frac{4}{7}$ of a ton to $\frac{9}{10}$ of an cwt.
*Facit* 12 *cwt.* 1 *qr.* 8 *lb.* 12 *oz* 12 *dr.* $\frac{8}{10}$.

13. Add $\frac{3}{4}$ of a mile to $\frac{7}{10}$ of a furlong, *Facit* 6 *fur.* 28 *pol.*

14. Add $\frac{1}{2}$ of a yard to $\frac{2}{3}$ of a foot, *Facit* 2 *feet* 2 *in.*

15. Add $\frac{1}{3}$ of a day to $\frac{1}{2}$ of an hour, *Facit* 8 *hrs.* 30 *min.*

16. Add $\frac{4}{9}$ of a chald. to $\frac{7}{8}$ of a buſh. *Facit* 16 *bush.* 4 *pecks* $\frac{1}{2}$.

17 Add $\frac{1}{3}$ of a week, $\frac{1}{4}$ of a day, and $\frac{1}{2}$ of an half hour together, *Facit* 2 *days*, 14 *hours*, $\frac{1}{2}$.

18. Add $\frac{2}{3}$ of a yard, $\frac{3}{4}$ of a foot, and $\frac{7}{8}$ of a mile together, *Facit* 1540 *yds.* 2 *feet*, 9 *in.*

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## OF SUBTRACTION of VULGAR FRACTIONS.

Q. HOW are Vulgar Fractions ſubtracted?

A. 1. Reduce the given fraction to a common denominator.

2. Subtract the leſſer numerator from the greater, and place that difference over the common denominator.

3. When the lower fraction is greater than the upper, ſubtract the numerator of the lower fraction from the denominator, and to that difference add the upper numerator, carrying one to the unit's place of the lower whole number.

*Note*, This Rule is proved by Addition

EXAMPLES.

1. From $\frac{111}{112}$ take $\frac{3}{4}$, - - - *Facit* $\frac{108}{448}$.
2. From $\frac{97}{100}$ take $\frac{3}{7}$, - - - *Facit* $\frac{379}{700}$.
3. From 96 $\frac{1}{3}$ take 14 $\frac{3}{7}$, - - *Facit* 81$\frac{19}{21}$.
4. From 96 take $\frac{3}{5}$, - - - *Facit* 95$\frac{2}{5}$.
5. From $\frac{1}{3}$ of 76 take $\frac{3}{4}$ of 21, - - *Facit* 9$\frac{7}{12}$.
6. From $\frac{109}{110}$ take $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$, - - *Facit* $\frac{1956}{2640}$.
7. From 71$\frac{1}{2}$ take $\frac{17}{19}$, - - *Facit* 70$\frac{23}{38}$.
8. From 14$\frac{1}{4}$ take $\frac{2}{3}$ of 19, - - *Facit* 1$\frac{7}{12}$.

Note, In order to find the following Facits, the fractions given muſt be reduced to their proper quantities by caſe 11, in Reduction, and then ſubtracted, as in Subtraction of whole Numbers.

9. From $\frac{1}{2}$ of a pound take $\frac{3}{4}$ of a ſhilling, *Facit* 9*s.* 3*d.*
10. From $\frac{1}{2}$ of a ſhilling take $\frac{3}{4}$ of a penny. *Facit* 5$\frac{1}{4}$.
11. From $\frac{3}{5}$ of an oz. take $\frac{7}{8}$ of a dwt. *Facit* 11 *dwts.* 3 *gr.*
12. From $\frac{1}{2}$ of an cwt. take $\frac{7}{12}$ of a pound.
*Facit* 1 *qr.* 27 *lb.* 6 *oz.* 10 *dr.* $\frac{8}{12}$.
13. From $\frac{2}{3}$ of a league take $\frac{7}{10}$ of a mile.
*Facit* 1 *mile*, 2 *furlongs*, 16 *poles.*
14. From 1 ell take $\frac{7}{10}$ of a qr. *Facit* 1 *yd.* 1 *na.* $\frac{2}{10}$.
15. From $\frac{3}{12}$ of a hhd. of beer take 1 gal. *Facit* 12 *gal.* $\frac{1}{2}$.
26. From $\frac{4}{8}$ of a chaldron take $\frac{2}{3}$ of a buſhel.
*Facit* 17 *buſhel*, 1 *peck* $\frac{1}{3}$.
17. From 7 weeks take 9 days $\frac{7}{10}$.
*Facit* 5 *weeks*, 4 *days*, 7 *hours*, 12 *min.*
18. From 4 days, 7 hours $\frac{1}{2}$, take 1 day 9 hours, $\frac{3}{18}$.
*Facit* 2 *days*, 22 *hours*, $\frac{1}{3}$.

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## OF MULTIPLICATION OF VULGAR FRACTIONS.

HOW are Vulgar Fractions multiplied?

A. 1. Prepare the given numbers (if need be) by the rules of reduction.

2. Multiply all the given numerators for a new numerator, and all the denominators for a new denominator.

*Note*, When any number, either whole or mixt, is multiplied by a fraction, the product is always leſs than the multiplicand, in the ſame proportion, as the multiplying fraction is leſs than 1 or an unit.

### Examples.

1. Multiply $\frac{3}{7}$ by $\frac{3}{11}$ - - *Facit* $\frac{9}{77}$.
2 Multiply $\frac{4}{8}$ by $\frac{7}{9}$ - - *Facit* $\frac{28}{72}$.
3. Multiply $\frac{1}{3}$ of $\frac{4}{5}$ by $\frac{7}{10}$ of $\frac{11}{12}$ - *Facit* $\frac{308}{1800}$.
4. Multiply $7\frac{1}{4}$ by $8\frac{1}{2}$ - - *Facit* $61\frac{5}{8}$.
5. Multiply $4\frac{1}{2}$ by $\frac{1}{8}$ - - *Facit* $\frac{9}{16}$.
6. Multiply $\frac{7}{8}$ by $13\frac{9}{10}$ - *Facit* $12\frac{13}{80}$.
7 Multiply $\frac{1}{2}$ of 7 by $\frac{3}{6}$ - - *Facit* $1\frac{9}{12}$.
8. Multiply $\frac{3}{5}$ of 8 by $\frac{7}{8}$ of 5 - - *Facit* 21.
9. Multiply $\frac{3}{6}$ by $\frac{4}{9}$ of 11 - *Facit* $2\frac{24}{54}$.
10. Multiply $\frac{4}{5}$ of 91 by $71\frac{1}{2}$ - *Facit* $5205\frac{2}{10}$.
11. Multiply $12\frac{3}{5}$ by $\frac{2}{6}$ of 7 - *Facit* $29\frac{12}{30}$.
12. Multiply $7\frac{1}{2}$ by $9\frac{1}{4}$ - *Facit* $69\frac{3}{8}$.

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## OF DIVISION OF VULGAR FRACTIONS.

*Q.* HOW are Vulgar Fractions divided?

A. 1. Prepare the numbers given (if need be) by the rules of reduction.

2. Multiply the denominator of the diviſor into the numerator of the dividend, for a new numerator; and the numerator of the diviſor into the denominator of the dividend, for a new denominator.

*Note,* 1. When the dividend is greater than the diviſor, the quotient will be greater than the dividend: but when the dividend is leſs than the diviſor, then the quotient will be leſs than the dividend, and in the ſame proportion as an unit is greater or leſs than the dividing fraction.

2. Multiplication and Diviſion prove each other.

### EXAMPLES.

1. Divide $\frac{17}{21}$ by $\frac{3}{5}$ - - - *Facit* $1\frac{22}{63}$.
2. Divide $\frac{13}{19}$ by $\frac{7}{9}$ - - - *Facit* $\frac{117}{133}$.
3. Divide $\frac{14}{18}$ by $\frac{7}{10}$ - - - *Facit* $1\frac{14}{126}$.
4. Divide $1\frac{1}{2}$ by $4\frac{8}{10}$ - - *Facit* $\frac{30}{96}$.
5. Divide $\frac{7}{8}$ by 4 - - - *Facit* $\frac{7}{32}$.
6. Divide 4 by $\frac{7}{8}$ - - - *Facit* $4\frac{4}{7}$.
7 Divide 99 by 108 - - *Facit* $\frac{99}{108}$.
8. Divide $\frac{1}{5}$ of 19 by $\frac{2}{3}$ of $\frac{3}{4}$ - *Facit* $7\frac{18}{30}$.
9. Divide $\frac{1}{2}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{3}{4}$ - - - *Facit* $\frac{24}{36}$.
10. Divide $\frac{2}{3}$ of $\frac{3}{4}$ by $\frac{1}{2}$ of $\frac{2}{3}$ - - *Facit* $1\frac{12}{24}$.
11. Divide $4\frac{5}{9}$ by $\frac{5}{9}$ of 4 - - *Facit* $2\frac{1}{20}$.
12. Divide $\frac{5}{9}$ of 4 by $4\frac{5}{9}$ - - *Facit* $\frac{20}{41}$.

## Of the SINGLE RULE of THREE DIRECT in VULGAR FRACTIONS.

Q. HOW is the Rule of Three in Fractions performed?

A. The operation of the Rule of Three in Fractions, both ſingle and double, vulgar and decimal, are exactly agreeable to the principles laid down in the ſame rules in whole numbers.

Q. How are the following examples proved?

A. By changing the order of them.

### EXAMPLES.

1. If $\frac{11}{13}$ lb. of ſugar coſt $\frac{7}{15}$ of a ſhilling, what coſt $\frac{32}{43}$ lb? *An.* $\frac{2912}{7095}$*s*=4*d.* 3 *qrs.* $\frac{4971}{7095}$.

2. If $\frac{3}{5}$ ell coſt $\frac{2}{3}$l—what coſt $\frac{12}{17}$ ell? *An.* 15*s.* 8*d.* $\frac{36}{153}$.

3. If $\frac{4}{7}$ ell coſt $\frac{7}{13}$l—what coſt 1 ell? *An.* 18*s.* 10$\frac{8}{52}$*d.*

4. If 2 oz. of ſilver coſt 16s. 5d—what coſt $\frac{3}{4}$ oz? *An.* 6*s.* 1*d.* 3 *qrs.* $\frac{1}{2}$.

5. If 6$\frac{1}{2}$ yards coſt 18s—what coſt 9$\frac{1}{4}$ yards? *An.* £1 : 5 : 7 : 1 *qr.* $\frac{28}{52}$.

6. If 1 dollar be worth 56$\frac{3}{5}$d—what are 500 dollars worth? *An.* £117 : 18 : 4.

7. If 1$\frac{1}{4}$ yard coſt 9s. what coſt 16$\frac{1}{4}$ yards? *An.* £5 : 17.

8. If 1 piſtole be 17$\frac{1}{5}$s—what are 100 piſtoles? *An* £86.

9. If $\frac{5}{7}$ oz. coſt $\frac{11}{12}$l—what coſt 1 oz? *An.* £1 : 5 : 8.

10. If an ingot of ſilver weighs 16$\frac{11}{15}$ oz what is it worth at 5s. 6d. *per* oz? *An.* £4 : 12 : 0 1 *qr.* $\frac{9}{15}$.

11. If $\frac{9}{10}$ cwt. coſt 14l. 4s—what will 7$\frac{1}{2}$ cwt. coſt? *An.* £118 : 6 : 8.

12. If $\frac{3}{5}$ of an ell coſt $\frac{2}{3}$ of 19s—what coſt 7 ells? *An* £7 : 7 : 9 : 1 *qr* $\frac{3}{9}$.

13. If 8 lb of tobacco coſt 4s. 9$\frac{3}{5}$d—what coſt 1 lb? *An* 7$\frac{1}{5}$*d.*

14. If 1 yard of broad cloth coſt 15$\frac{5}{8}$s—what will 4 pieces, each containing 27$\frac{3}{8}$ yards coſt? *An.* £85 : 10 : 11$\frac{1}{4}$.

15 A mercer bought 3$\frac{1}{2}$ pieces of ſilk, each containing 24$\frac{1}{3}$ yards, at 6s. 0$\frac{1}{2}$d. *per* yard,—I demand the value of the 3 pieces $\frac{1}{2}$ at that rate? *An.* £25 : 14 : 6 : 2 *qr.* $\frac{4}{12}$.

16. If $\frac{1}{3}$ lb. leſs by $\frac{1}{6}$ coſt 13$\frac{1}{5}$d. what coſt 14 lb. leſs by $\frac{1}{5}$ of 2 lb? *An.* £4 : 9 : 9$\frac{3}{25}$.

17. A merchant had 5$\frac{8}{9}$ cwt. of ſugar, at 6$\frac{3}{4}$d *per* lb. which he would barter for tea, a 8$\frac{}{8}$s *per* lb—I demand how much tea muſt be given for the ſugar? *An.* 43 *lb.* $\frac{6}{414}$.

18. Bought 120lb. of tea, at 8$\frac{5}{8}$s *per* lb. and ſold it for 70l.—what was the gain *per cent*? *An.* £35 : 5 : 3 : 3 *qr.* $\frac{75}{1035}$.

## OF the SINGLE RULE of THREE INVERSE in VULGAR FRACTIONS.

1. IF $3\frac{1}{4}$ yards of cloth that is $1\frac{1}{5}$ yard wide, be ſufficient to make a cloak ;—how much muſt I have of that ſort which is $\frac{4}{5}$ of a yard wide, to make a cloak of the ſame bigneſs ? *An.* $4\frac{7}{8}$ *yards.*

2. If 16 men finiſh a piece of work in $28\frac{1}{5}$ days, how long will 12 men require to do the ſame work ? *An.* $37\frac{28}{38}$ *days.*

3. If $1\frac{1}{4}$ yard in breadth require $20\frac{1}{2}$ yards long to make a garment ; what length will $\frac{3}{4}$ of a yard wide require to make the ſame ? *An.* $34\frac{4}{24}$ *yards.*

4. How many pieces of merchandize at $20\frac{1}{8}$s. *per* piece are to be given for $240\frac{1}{7}$ pieces, at $12\frac{1}{2}$s. *per* piece ?

*An.* $149\frac{354}{2254}$ *pieces.*

5. How many yards of canvas that is $1\frac{1}{4}$ yard wide will be ſufficient to line 20 yards of Say that is $\frac{3}{4}$ of a yard wide ? *An.* 12 *yards of canvas.*

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## OF the DOUBLE RULE of THREE IN VULGAR FRACTIONS.

1. IF 9 ſtudents ſpend $10\frac{7}{8}$l. in 18 days, how much will 20 ſtudents ſpend in 30 days ? *An.* £39 : 18 : 4 $\frac{360}{1458}$.

2. Three men, having worked $19\frac{1}{2}$ days, received $8\frac{9}{10}$l. —how much muſt 20 men have for $100\frac{1}{4}$ days ?

*An.* £305 : 0 : 8 $\frac{96}{468}$.

3. A man and his wife having laboured 1 day, earned $4\frac{5}{8}$s—I demand how much they muſt have for $10\frac{1}{2}$ days, when their two ſons helped them ? *An.* £4 : 17 : $1\frac{1}{2}$.

4. A man with his family, which in all were 5 perſons, did uſually drink $7\frac{4}{5}$ gallons of beer in a week ;—how much will be drank in $22\frac{1}{2}$ weeks, when three perſons more come into the family ? *An.* $280\frac{40}{50}$ *gal.*

5. Seven men with their wives, upon examining into their expences for 20 weeks paſt, found that they had laid out $40\frac{4}{5}$l—I demand in what time $20\frac{3}{7}$l. may be ſpent by 46 men in the like proportion ? *An.* 3 *weeks* $\frac{3136}{65688}$.

6. Three ſailors having been abroad $9\frac{1}{4}$ months, received $40\frac{3}{15}$l—I demand how much 100 ſailors muſt receive for $28\frac{3}{7}$ months ſervice? *An.* £4118 : 6 : 0 : 1 *qr.* $\frac{1305}{11655}$.

# THE

# SCHOOLMASTER'S ASSISTANT.

## PART III.

## OF DECIMAL FRACTIONS.

Q. WHAT do you underſtand by Decimals in general?

A. Any thing which is called ONE; as one foot, one pound, one ſhilling, one year, &c. is conceived in imagination to be divided into ten equal parts, and every one of thoſe parts into ten other equal parts, and ſo on, by a decimal diviſion without end.

Q. What is a Decimal Fraction?

A. Any number having a point placed before it, thus, .641, is a Decimal.

Q. How do you diſtinguiſh a whole number from a Decimal Fraction?

A. Any number having a point placed after it, thus, 641. is a whole number.

Q. What is a mixt number?

A. Any quantity of figures having a point placed ſomewhere between them, thus, 6.41, or thus, 64.1, is a mixt number.

*Note*, The decimal points muſt never be omitted; becauſe without it a decimal cannot be diſtinguiſhed from a whole or mixt number. But when a whole number alone is given, it is as common to omit it as to inſert it; as appears by ſeveral examples following.

## OF NOTATION OF DECIMALS.

Q. HOW do Decimal Places increaſe?

A. In the ſame manner as whole numbers do; that is, by tens: For every place towards the left hand is ten times greater than that which is next it towards the right hand, as appears by the following table:

| C Thouſands. | X Thouſands. | Thouſands. | Hundreds. | Tens. | Units. | Tenth Parts. | Hundred Parts. | Thouſ. Parts. | X Thouſ. Parts. | C Thouſ. Parts. |
|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 5 | 4 | 3 | 2 | 1 | .2 | 3 | 4 | 5 | 6 |

*Q.* May not cyphers ſometimes be annexed to decimals?

*A.* They may, but they alter not their value: Thus, .41 and .4100 are the ſame.

Q. May not cyphers ſometimes be prefixed to decimal parts?

*A.* Yes; and then they decreaſe their value, by removing them farther from the point: Thus, .0041 is leſs than .41.

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## OF ADDITION AND SUBTRACTION OF DECIMALS.

*Q.* HOW are Decimals added or ſubtracted?

*A.* Place the numbers according to their value, and work as in addition or ſubtraction of whole numbers.

Q. How are the operations proved?

*A.* As in whole numbers.

### EXAMPLES in ADDITION.

| *Shillings.* | *Yds.* | *Gallons.* | *£.* |
|---|---|---|---|
| 14.471 | 47.4 | 7004.16 | 71.001 |
| 1.191 | 19.71 | 712.712 | 120.07 |
| 1.8126 | 371.721 | 19.0174 | 31.121 |
| 3.6126 | 400.004 | 7.3126 | 14.4101 |
| 7.1281 | 7.1004 | 71.1851 | 76.04 |
| 18.8126 | 7.07 | 3.108 | 7.3 |

| *Miles.* | *lb.* | *Acres.* | *Ounces.* |
|---|---|---|---|
| 41.8102 | 86.18104 | .61271 | 48.9107 |
| 140.037 | 3.13 | .8712 | 1.8191 |
| 18.10 | 1.14 | .012 | 3.1080 |
| 7.8141 | 7.7121 | .87 | .7012 |
| 16.4612 | 8.19817 | .04 | .0012 |
| 117.81 | 14.071 | .6 | .1800 |

### EXAMPLES IN SUBTRACTION.

| | *Years.* | *Days.* | *Weeks.* | *Hours.* |
|---|---|---|---|---|
| *From* | 1081.761 | 712.10009 | 127.19 | 12. |
| *Take* | 10.00012 | 7.121 | 121. | 12. |
| *Rem.* | | | | |

| | *Minutes.* | *Months.* | *Ells.* | *Tuns.* |
|---|---|---|---|---|
| *From* | 174.1 | 6100. | .172618 | 761.8109 |
| *Take* | 1.471 | 6.100 | .0000148 | 18.9112 |
| *Rem.* | | | | |

## OF MULTIPLICATION OF DECIMALS.

Q. HOW are decimals multiplied ?
A. As whole numbers are.

*Note* 1. When numbers are multiplied, make as many decimal parts in the product, as there are in the two factors taken together.

2. If decimal places are wanted in the product, ſupply them with cyphers to the decimal point.

3 Obſerve the ſame note here, which is given in Multiplication of Vulgar Fractions.

Q. How are the following examples proved ?
A. By inverting the factors.

1. Multiply .612 by 4.12
2. Multiply 48. by .48
3. Multiply 37.9 by 46.5
4. Multiply .121 by 17.2
5. Multiply 1.81 by 71.
6. Multiply 4.1 by 1.42
7. Multiply .00071 by .121
8. Multiply .00041 by .00017
9. Multiply .0027 by 41.
10. Multiply 410. by 10012
11. Multiply .07 by .07
12. Multiply 1.007 by .041
13. Multiply 4.001 by .004
14. Multiply .004 by .004

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## OF DIVISION OF DECIMALS.

Q. HOW are Decimals divided?
A. As whole Numbers are.

*Note* 1. The decimal places of the diviſor and quotient muſt always be equal to thoſe in the dividend.

2. If there be more decimals in the diviſor than in the dividend, annex as many cyphers as you pleaſe to the dividend, ſo as to be equal at leaſt to the diviſor.

3. If decimal places are wanting in the quotient, they muſt be ſupplied with cyphers to the decimal point.

4. Obſerve the ſame note here, which is given in Diviſion of Vulgar Fractions.

Q. How are the following examples to be proved.
A. By Multiplication.

EXAMPLES.

1. Divide 19.4 by 37.5
2. Divide 47121.1 by 47.
3. Divide 4.18 by .1812
4. Divide .76121 by 41.
5. Divide .612821 by 7.21
6. Divide .12181 by .721
7. Divide 9. - - - by .7121
8. Divide 9. - - - by .9
9. Divide 14. - - by 47.31
10. Divide 1. - - - by .863
11. Divide .012181 by .12
12. Divide .8001212 by .018

# OF REDUCTION OF DECIMALS.

## Caſe I.

Q. HOW do you reduce a vulgar Fraction to a Decimal?

A. Divide the upper term by the lower.

Note, 1. Both terms are to be eſteemed whole numbers.

2. By this caſe, tables containing the Decimal parts of an integer are conſtructed.

### EXAMPLES.

1. Reduce $\frac{5}{26}$ to a decimal. *Facit* 1923076+
2. Reduce $\frac{5}{28}$ to a decimal. *Facit* .1785714+
3. Reduce $\frac{11}{14}$ of $\frac{10}{13}$ to a decimal. *Facit* .6043956+
4. Reduce 7s. 6d. to the decimal of a pound. *Facit* .375*l.*
5. Reduce 10s. 9$\frac{1}{4}$d. to the decimal of a pound. *Facit* .5385416+*l.*
6. Reduce 24 grains to the decimal of a lb. Troy. *Facit* .0041666+*lb.*
7. Reduce 14 drams to the decimal of a lb. Avoirdupois. *Facit* .0546875*lb.*
8. Reduce 4 cwt 2 qrs to the decimal of a ton. *Facit* .225 *ton.*
9. Reduce 14 cwt to the decimal of a ton. *Facit* .7 *ton.*
10. Reduce 174 drams to the decimal of an cwt. *Facit* .0060686+*cwt.*
11. Reduce 4 inches to the decimal of a yard. *Facit* .1111111+*yard.*
12. Reduce 76 yards to the decimal of a mile. *Facit* .04318181+*mile.*
13. Reduce 1 mile to the decimal of a league. *Facit* .33333333+*league.*
14. Reduce 3 qrs. 2 na. to the decimal of a yard. *Facit* .875 *yard.*
15. Reduce 4 perches to the decimal of an acre. *Facit* .025 *acre.*
16. Reduce 1 pint to the decimal of a gallon. *Facit* .125 *gal.*
17. Reduce 1 gallon of wine to the decimal of a hhd. *Facit* .015873+*hhd.*
18. Reduce 7 minutes to the decimal of a day. *Facit* .0048611+*day.*
19. Reduce 2 days to the decimal of a week. *Facit* .2857142+*week.*
20. Reduce 72 days to the decimal of a year. *Facit* .1972602+*year.*

## Caſe II.

Q. How do you find the proper quantity of a Decimal Fraction in the known parts of an Integer?

A. Multiply it by the common parts of the integer.

Q. How do you prove queſtions in this caſe?
A. By Caſe I.

### EXAMPLES.

1. What is the proper quantity of .76 of a pound?
*Anſ.* 15*s.* 2*d.* 1.6 *qr.*

2. What is the proper quantity of .861 of a cwt.?
*Anſ* 3 *qrs.* 12*lb* 6 *oz.* 14.592 *dr.*

3. What is the proper quantity of .461 of a ſhilling?
*Anſ.* 5*d.* 2.128 *qrs.*

4. What is the proper quantity of .761 of a hhd. of wine.
*Anſ.* 47 *gals.* 3 *qrs.* 1.544 *pt.*

5. What is the proper quantity of .17 of a tun of wine?
*Anſ.* 42 *gals.* 3 36 *qts.*

6. What is the proper quantity of .761 of a day?
*An.* 18 *hrs.* 15 *min.* 50.4 *ſec.*

7. What is the proper quantity of .7 of a lb. of ſilver?
*Anſ.* 8 *oz* 8 *dwts.*

8. What is the proper quantity of .71 of 4 oz. of gold?
*An.* 2 *oz.* 16 *dwts.* 19.2 *gr.*

9. What is the proper quantity of .67 of a league?
*An.* 2 *miles,* 0 *fur.* 3 *poles,* 1 *yd.* 0 *feet,* 3 *in.* 18 *b. c.*

10. What is the proper quantity of .712 of a furlong?
*An.* 28 *poles,* 2 *yds.* 1 *foot,* 11.04 *in.*

11. What is the proper quantity of .07 of a barrel of ale?
*An.* 2 *galls.* .92 *pt.*

12. What is the proper quantity of .4712 of an ell Engliſh?
*An.* 2 *qrs.* 1.424 *na.*

13. What is the proper quantity of .72 of a hhd. of beer?
*An* 38 *gals.* 3.52 *qts.*

14. What is the proper quantity of .61 of a ton of wine?
*An.* 2 *hhds.* 27 *galls.* 2 *qts.* 1.76 *pt.*

15. What is the proper quantity of .092 of 3 acres, 2 roods?
*An.* 1 *rood* 11.52 *poles.*

16. What is the proper quantity of .461 of a chaldron of coals?
*An.* 16 *buſh.* 2.384 *pecks.*

17. What is the proper quantity of .712 of 3 qrs. of corn?
*An.* 17 *buſh.* 2.816 *qrs.*

18. What is the proper quantity of .3 of a year?
*Anſ* 109 *days,* 12 *hrs.*

19. What is the proper quantity of .5 of an hour? *An.* 30 *m.*

20. A certain tenant hired an houſe for 9 years at 12.4l. *per annum*;—how much was due at the end of the term?
*Anſ.* £111 : 12*s.*

*Note* 1. To this caſe is referred Caſe IV. in practice, p. 65.

EXAMPLE.

1286 at 4s.
1ſt. 4s. = .2l.
2d. 1286
.2
——
257.2
20
——
4.0

*Facit* £257 : 4s.

2. Addition and Subtraction of Decimals of different Denominations may eaſily be performed, after the Decimals are reduced to their proper quantities.

EXAMPLES.

1. What is the ſum of .48l and .16s. reduced to their proper quantities? *Anſ.* 9*s.* 9.12*d.*

2. What is the ſum of 17lb. Troy, and .84 oz? *Anſ.* 2 *oz.* 17 *dwts.* 14.4 *gr.*

3. What is the ſum of .17 ton, .19 cwt. .17 qr. and .7lb? *Anſ.* 3 *cwt.* 2 *qrs.* 15.54 *lb.*

4. What is the difference between .17l. and .7s? *An* 2*s.* 8*d.* 1.6 *qrs.*

5. What is the difference between .41 days, and .16 hours? *An.* 9 *hrs.* 40 *min.* 48 *ſec.*

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## OF THE SINGLE RULE OF THREE DIRECT IN DECIMALS.

Q. HOW do you prove the following queſtions?
A. By changing their order.

EXAMPLES.

1. If 1.4lb. of mace coſt 14.5s.—what coſt 75.31lb? *An.* 38 : 19 : 11 : 3.52 *qrs.*

2. If 1.6 cwt. of ſugar coſt 3l. 12.76s.—what coſt 3 hhds. each 11 cwt. 3 qrs. 10.12lb? *An.* £80 : 15 : 3 : 3.36 *qrs.*

3. If 1.5 oz. of ſilver be worth 7.8s.—what is the value of 9.7lb. *An.* 30*l.* 5*s.* 3*d.* 1.44 *qr.*

4. If 1.37 cwt of ſugar be worth 4.5l.—what is 1.7lb. worth at that rate? *An.* 11.1*d.*

5. If 1 pint of wine coſt 1.2s.—what coſt 12.5 hhds? *An.* £378.

6. If 8.4lb. of tobacco coſt 16s. 4.6d.—what coſt 3 hhd. each 4 cwt. 2 qrs. 7.4lb? *An.* £149 : : 12 : 3 : 2 *qrs.*

7. If 1 yard of cloth coſt 12.3s,—what coſt 3 pieces, each 2.15 yards? *An.* £39 : 13 : 4.2.

8. A man bought a piece of cloth for 6l. 13.12s.—I demand how many yards there were in the ſame when he gave after the rate of 4s. 2.6d. *per* yard? *An.* 31.569 *yards.*

9. A man bought 5.8 tuns of oil for 60.4l. but by misfortune it chanced to leak out 50.9 gallons;—I demand how he muſt ſell the reſt *per* gallon to be no loſer?

*Anſ.* 10.27*d per gallon.*

10. Two men bartered, *A* had 40.7 yards of linen, for which *B* gave him 25.6 ells of holland, at 4.5s. *per* ell;—I demand the price of the linen *per* yard? *An.* 2*s.* 9*d.* 3.8 *qr.*

11. A grocer bought 7.6 cwt. of ſugar, at 40.1s. *per cent.* and ſold the ſame out at 4.5d. *per* lb.—I demand whether he gained or loſt, and how much? *An.* 14*s.* 5*d.* 1.12 *qr gain.*

12. A brewer made a quantity of beer, which coſt him 90.4l. and afterwards ſold it out at 26.7s. *per* barrel, by which he gained 10l.—I demand the quantity that was brewed?

*An.* 75 *bar.* 7.4+*gals.*

13. A grocer bought 3 cwt. 1.5 qr. of cloves, at the rate of 2.75s. *per* lb. and ſold them for 60l. 11s. 6d. what did he gain or loſe by the bargain? *An. He gained* £8 : 12*s.*

14. A merchant bought 436 yards of cloth for 8.5s. *per* yard, and ſold it again for 10.75s. *per* yard,—what did he gain by the ſale thereof? *An.* £49 : 1*s. gain.*

15. A owes B 296.85l. but he compounds for 7.5s. in the pound;—what muſt B receive for his debt?

*An.* £111 : 6 : 4 : 2 *qrs.*

16. Bought 3 hhds. of tobacco, each weighing 4 cwt. 1.9 *qr.* at 5.6l. *per* cwt. which I ſold out at 7l. 16s. *per* cwt.—what did I gain by the whole? *An.* £29 : 10 : 8 : 1.6 *qr.*

17. A jeweller bought a diamond for 60 guineas, and after it was neatly cut, weighed 1.5 oz. which he ſold again for 3.25s. *per* grain;—I demand how much he gained by the ſaid diamond; and alſo at what rate *per cent.* he made his gain?

*An.* { *Whole gain* £54 : 0 : 0 : 0 *qr.*
*Gain per cent.* 85 : 14 : 3 : 1.7 +

## OF THE SQUARE ROOT.

Q. WHAT is a ſquare?

A. Any number multiplied by itſelf produces a Square?

Q. What is the Extraction of the Square-Root?

A. If a Square be given to find one ſide, it is called the Extraction of the Square-root.

Q. How is the given Square to be prepared for Extraction?

A. By pointing off at every two figures, from the unit's place both ways, for a reſolvend.

Q. What is a Surd?

A. It is an imperfect Square, or ſuch a number, whoſe Square Root can never be exactly found.

### EXAMPLES.

1. What is the ſquare of 17.1? *Anſ.* 292.41
2. What is the ſquare of .09? *Anſ.* .0081
3. What is the ſquare of .0094? *Anſ.* .00008836
4. What is the ſquare root of 4712.81261? *Anſ.* 68.649+
5. What is the ſquare root of 9712.718051? *Anſ.* 98.553+
6. What is the ſquare-root of 3.1721812? *Anſ.* 1.78106+
7. What is the ſquare-root of 1.3976121? *Anſ.* 1.1822+
8. What is the ſquare root of 761.801216? *Anſ.* 27.6007+
9. What is the ſquare root of .0007612816? *Anſ.* .02759+
10. What is the ſquare-root of 4.000067121? *Anſ.* 2.000016+

11. There is an army conſiſting of a certain number of men, who are placed rank and file, that is, in the form of a ſquare, each ſide having 472 men;—I demand how many men the whole ſquare contains? *Anſ.* 222784 *men.*

12. The floor of a certain great room is made exactly ſquare, each ſide of which contains 75 feet;—I demand how many ſquare feet are contained therein? *Anſ.* 5625 *feet.*

13. Suppoſe 12544 ſoldiers are to be put into rank and file, in the form of an equal ſquare;—I demand how many ſoldiers will be in the front, and how many deep? *Anſ.* 112.

14. A certain ſquare pavement contains 197136 ſquare ſtones, all of the ſame ſize;—I demand how many are contained in one of its ſides? *Anſ.* 444.

# *OF CONVERG*

OR

# EXTRACTING THE ROO

*(A TABLE OF*

| | | | | | |
|---|---|---|---|---|---|
| *Roots, or 1ſt powers - -* | 1 | 2 | 3 | 4 | |
| *Squares, or 2nd powers - -* | 1 | 4 | 9 | 16 | 2 |
| *Cubes, or 3d. powers. - -* | 1 | 8 | 27 | 64 | 12 |
| *Biquadrates, or 4th powers -* | 1 | 16 | 81 | 256 | 62 |
| *Surſolids, or 5th powers -* | 1 | 32 | 243 | 1024 | 312 |
| *Square cubes, or 6th powers* | 1 | 64 | 729 | 4096 | 1562 |
| *Second ſurſolids, or 7th powers* | 1 | 128 | 2187 | 16384 | 7812 |
| *Biquadrates ſquared, or 8th pr.* | 1 | 256 | 6561 | 65536 | 39062 |
| *Cubes cubed, or 9th powers* | 1 | 512 | 19683 | 262144 | 195312 |
| *Surſolids ſquared, or 10th powers* | 1 | 1024 | 59049 | 1048576 | 976562 |
| *Third ſurſolids, or 11th powers* | 1 | 2048 | 177147 | 4194304 | 4882812 |
| *Square-cubes ſquared, or 12th pr.* | 1 | 4096 | 531441 | 16777216 | 24414062 |
| *Fourth ſurſolids, or 13th powers* | 1 | 8192 | 1594323 | 67108864 | 122070312 |
| *2nd ſurſolids ſquared, or 14th pr.* | 1 | 16384 | 4782969 | 268435456 | 610351562 |
| *Surſolids cubed, or 15th powers* | 1 | 32768 | 14348907 | 1073[illegible]41824 | 3051757812 |

# RGING SERIES;

OR

# ROOTS OF ALL POWERS.

## E OF POWERS)

| | | | | |
|---:|---:|---:|---:|---:|
| 5 | 6 | 7 | 8 | 9 |
| 25 | 36 | 49 | 64 | 81 |
| 125 | 216 | 343 | 512 | 729 |
| 625 | 1296 | 2401 | 4096 | 6561 |
| 3125 | 7776 | 16807 | 32768 | 59049 |
| 15625 | 46656 | 117649 | 262144 | 531441 |
| 78125 | 279936 | 823543 | 2097152 | 4782969 |
| 390625 | 1679616 | 5764801 | 16777216 | 43046721 |
| 1953125 | 10077696 | 40353607 | 134217728 | 387420489 |
| 9765625 | 60466176 | 282475249 | 1073741824 | 3486784401 |
| 48828125 | 362797056 | 1977326743 | 8589934592 | 31381059609 |
| 44140625 | 2176782336 | 13841287201 | 68719476736 | 282429536481 |
| 20703125 | 13060694016 | 96889010407 | 549755813888 | 2541865828329 |
| 03515625 | 78364164096 | 678223072849 | 4398046511104 | 22876792454961 |
| 17578125 | 470184984576 | 4747561509943 | 35184372088832 | 205891132094649 |

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15. The wall of a town is 17 feet high, which is ſurrounded by a moat of 20 feet in breadth ;—I demand the length of a ladder which ſhall reach from the outſide of the moat to the top of the wall ? *Au.* 262 + *feet.*

### *Of the Square-Root of a Vulgar Fraction*

Q. How is the Square-Root of a Vulgar Fraction extracted ?

A. 1. Reduce the Fraction to its loweſt terms.

2. Extract the ſquare-root of the numerator for a new numerator, and the ſquare-root of the denominator for a new denominator.

3. If the fraction be a ſurd, reduce it to a decimal, and then extract the ſquare-root from it.

4. The decimal fractions muſt conſiſt of an even number of places, as two, four, &c.

EXAMPLES.

1. What is the ſquare-root of $\frac{1044}{6849}$ ? *An.* $\frac{2}{7}$.
2. What is the ſquare-root of $\frac{3456}{5400}$ ? *An.* $\frac{4}{5}$.
3. What is the ſquare root of $\frac{7056}{9216}$ ? *An.* $\frac{7}{8}$.

SURDS.

4. What is the ſquare-root of $\frac{3168}{6192}$ ? *An.* .71528+
5. What is the ſquare-root of $\frac{208}{272}$ ? *An.* .87447+
6. What is the ſquare-root of $\frac{387}{738}$ ? *An.* .72414+

### *Of the Square-Root of a Mixt Number.*

Q. How is the Square-root of a Mixt number extracted ?

A. 1. Reduce the fractional part of the mixt number to its loweſt terms.

2. Reduce the mixt number to an improper fraction.

3. Extract the roots of the numerator and denominator, for a new numerator and denominator.

4. If the mixt number given be a ſurd, reduce the fractional part to a decimal and annex it to the whole number, and extract the ſquare-root from the whole.

EXAMPLES.

1. What is the ſquare-root of $37\frac{36}{49}$ ? *An.* $6\frac{1}{7}$.
2. What is the ſquare-root of $17\frac{16}{25}$ ? *An.* $4\frac{1}{5}$.
3. What is the ſquare-root of $5\frac{288}{648}$ ? *An.* $2\frac{1}{3}$.

SURDS.

4. What is the ſquare root of $76\frac{14}{17}$ ? *An.* 8. 7649+
5. What is the ſquare-root of $78\frac{9}{11}$ ? *An.* 2.7961+

## Of the CUBE-ROOT.

Q. WHAT is a Cube?

*A.* Any number multiplied by its ſquare produces a Cube.

*Q.* What is the Extraction of the Cube-Root?

A. If a cube be given to find out a number, which being multiplied into its ſquare, produceth the number given; this is called the Extraction of the Cube-Root.

*Q.* How is the given cube to be prepared for Extraction?

*A.* By pointing off at every three figures both ways, from the unit's place, for a Reſolvend.

Q. What is a Surd?

A. It is an imperfect Cube, or ſuch a number, whoſe Cube-Root can never be exactly found.

Q. What is the rule for extracting the Cube-Root of a number?

*A.* This: The firſt figure ſought is the Root of the greateſt cube contained in the firſt member, and it is called *a*; then $3aa+3a$ is the diviſor which finds a new figure, called *e*; then $3aae+3eea+3eee$ is the ſubtrahend or number to be ſubducted; which operation is to be continued to every reſolvend.

Note, This rule being ſomewhat dark, I ſhall, by way of illuſtration, ſubjoin the Operation at large, for extracting the Cube-Root of any number.

Q. What is the Cube-Root of 444194·947?

A. (1.) Let the given number be pointed as before directed.

· · ·

*thus* 444194·947

(2.) The firſt member, which contains the greateſt Cube, is 444; and the neareſt root, whoſe cube is not greater than it, is 7; which ſet

· · ·

*thus* 444194·947(7

(3.) The cube of 7 is 343; which ſet down and ſubtract, annexing the next three figures or members, viz. 194, for a reſolvend;

· · ·

*thus* 444194·947(7

343

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101194 Reſolvend.

(4.) The number 7, in the root is called *a*; then by the rule 3*aa*+3*a* is the diviſor; thus,

7 = a
7 = a
. . .
49 = aa    444194·947(7
3    343
147 = 3aa    1491)101194 Reſolvend
21 = 3aa
Diviſor 1491 = 3aa+3a

(5.) The next figure in the root, viz. 6 (found by common diviſion) is called *e*; then by the rule 3*aae*+3*eea*+*eee*, is the ſubtrahend, or number to be ſubducted: thus,

147 = 3aa    6 = e
6 = e    eee viz. 6=216    6 = e
882 = 3aae    36 = ee
756 = 3eea    3
216 = eee    108 = 3ee
Sub. 95976 = 3aae+3eea+eee    7 = a
. . .    756 = 3eea
444194·947(76
343
1491)101194 Reſolvend
95976 Subtrahend
5218.947 Reſolvend.

(6.) When the next member is brought down, viz 947 as before, both figures in the root, viz. 76 muſt be called *a*; then to find a diviſor to this laſt reſolvend, ſay as before, 3*aa*+3*a*; thus,

76 = a    76 = a
76 = a    3    . . .
456    228 = 3a    444194·947(76
432    343
5776 = aa    1491)101194 Reſolvend
3    95976 Subtrahend
17328 = 3aa    173508)5218.947 Reſolvend
228 = 3a
Diviſor 173508 = 3aa+3a

(7.) The next figure in the root, viz. 3, found as before, is alſo called *e*; then again *3aae + 3eea + eee* is the other ſubtrahend, or number to be ſubducted; thus,

17328 = 3aa
3 = e
51984 = 3aae
2052 = 3eea
27 = eee
Sub 5218947 = 3aae + 3eea + eee

eee viz. 3 = 27

3 = e
3 = e
9 = ee
3
27 = 3ee
76 = a
162
189
2052 = 3eea

444194 947(76.3 *Anſwer.*
343
1491)101194 Reſolvend
95976 Subtrahend
173508)5218.947 Reſolvend
5218.947 Subtrahend.
0

EXAMPLES.

| | |
|---|---|
| 1. What is the cube of 6.4? | *An.* 262.144 |
| 2. What is the cube of 13? | *An.* 002197 |
| 3. What is the cube of 41.1? | *An.* 69426.531 |
| 4. What is the cube of .09? | *An.* .000729 |
| 5. What is the cube of .007? | *An.* 000000343 |
| 6. What is the cube root of 7612.812161? - | *An.* 19.67 + |
| 7. What is the cube root of 76121.7612? - - | *An.* 196.71 + |
| 8. What is the cube root of 61318.00121? - | *An.* 36.41 + |
| 9. What is the cube-root of 7121.1021698? - | *An.* 19.238 + |
| 10. What is the cube root of 12000.812161? | *An.* 22.89 + |
| 11. What is the cube root of .121861281? - | *An.* .495 + |
| 12. What is the cube-root of .0069761218? - | *An.* .19107 + |

13. If a cubical piece of timber be 41 inches long, 41 inches broad, and 41 inches deep, how many cubical inches doth it contain? *An.* 68921 *cubical inches.*

14. Suppoſe a cellar to be dug that ſhall be 12 feet every way, in length, breadth, and depth? —how many ſolid feet of earth muſt be taken out to complete the ſame? *Anſ* 1728 *feet.*

15. Suppoſe a ſtone of a cubic form to contain 474552 ſolid inches;—what is the ſuperficial content of one of its ſides? *Anſ.* 6084 *inches.*

## *Of the Cube-Root of a Vulgar Fraction.*

Q. How do you extract the Cube Root of a Vulgar Fraction?

A. 1. Reduce the Fraction to its loweſt terms.

2. Extract the cube roots of the numerator and denominator for a new numerator and denominator.

3. If the fraction be a ſurd, reduce it to a decimal, and then extract the cube-root from it.

4. The decimal fraction muſt conſiſt of ternaries of places; as three, ſix, nine, &c.

EXAMPLES.

1. What is the cube-root of $\frac{352}{1188}$? *Anſ.* $\frac{2}{3}$.
2. What is the cube-root of $\frac{1944}{4608}$? *Anſ.* $\frac{3}{4}$.
3. What is the cube-root of $\frac{648}{3000}$? *Anſ.* $\frac{3}{5}$.

SURDS.

4. What is the cube-root of $\frac{4}{9}$? *Anſ.* .763 +
5. What is the cube-root of $\frac{6}{7}$? *Anſ.* .949 +
6. What is the cube root of $\frac{1}{3}$? *Anſ* .693 +

## *Of the Cube-Root of a Mixt Number.*

Q. How do you extract the cube-root of a mixt Number?

A. 1. Reduce the fractional part to its loweſt terms.

2. Reduce the mixt number to an improper fraction.

3. Extract the cube-roots of the numerator and denominator, for a new numerator and denominator.

4. If the mixt number given be a ſurd, reduce the fractional part to a decimal, and annex it to the whole number, and extract the cube-root from the whole.

EXAMPLES.

1. What is the cube root of $578\frac{19}{27}$? *Anſ.* $8\frac{1}{3}$.
2. What is the cube-root of $42\frac{11}{24}$? *Anſ.* $3\frac{1}{2}$.
3. What is the cube-root of $5\frac{104}{125}$? *Anſ* $1\frac{4}{5}$.

SURDS.

4. What is the cube-root of $8\frac{2}{12}$? *Anſ.* 2.013 +
5. What is the cube root of $7\frac{3}{5}$? *Anſ.* 1.966 +

## OF THE BIQUADRATE ROOT.

Q. WHAT is a Biquadrate Number.

A. Any number involved four times produces a biquadrate.

Q. How is the biquadrate-root extracted?

A. Firſt extract the ſquare-root of the given reſolvend and then extract the Square-root of that Square-root, for the biquadrate-root required.

### EXAMPLES.

1. What is the biquadrate-root of 48? *Anſ.* 5308416.
2. What is the biquadrate-root of 96? *Anſ.* 8493465.
3. What is the biquadrate-root of 5308416? *An.* 48.
4. What is the biquadrate-root of 84934656? *An.* 96.
5. What is the biquadrate-root of 21743271936? - - - - - } *Anſ.* 384.

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## OF THE SURSOLID ROOT.

Q. WHAT is a Surſolid?

A. Any number involved five times, produces a Surſolid?

Q. How is the Surſolid Root, or the Root of any other higher power extracted?

A. By the following general rules.

1. If any even power be given, let the ſquare-root of it be extracted, which reduces it to half of the given power, then the ſquare-root of that power reduces it to half of the ſame power; and ſo on till you come to a ſquare or a cube.

For example: Suppoſe a 24th power be given; the ſquare-root of that reduces it to a 12th power; the ſquare-root of the 12th power reduces it to a 6th power; and the ſquare-root of the 6th power to a cube.

2. If any odd power be given, as the 17th, &c. obſerve,

(1) From the Unity Place both ways, point off at every ſuch number of figures as in the index of the power, for a reſolvend.

(2) Seek in the table of powers for ſuch a power, (being the ſame power with the index) as comes neareſt the firſt period, whether greater or leſs, calling its root accordingly more than juſt, or leſs than juſt.

(3) Annex ſo many cyphers to the root, as there are periods of whole numbers in the given reſolvend.

(4) Find the difference between the given reſolvend and the power coming neareſt the firſt period.

(5) Whatever odd power is given, the next loweſt odd power to that of the ſaid root muſt be found, with its annexed cyphers: *i. e.* if the 9th power be given, find the 7th power of the root and cyphers: if the 11th power be given, find the 9th, *&c.*

(6) Multiply the next loweſt odd power by the index of the given power, and let that product be a diviſor to the difference between the given reſolvend and power firſt found, which depreſſes it to a ſquare.

(7) Point this ſquare into periods of two figures each.

(8) Then make the firſt root without its cyphers a diviſor, and aſk how oft it may be found in the firſt period of the ſquare.

(9) If the diviſor be leſs than juſt, you muſt multiply the quotient figure by half the index, *i. e.* if the index be 11, multiply the quotient figure by 5; if the index be 9, multiply it by 4, *&c.* and add it to the diviſor; but if it be more than juſt, you muſt ſubtract it from the diviſor; having a cypher annexed, or ſuppoſed to be annexed, to the diviſor; which ſum or difference muſt be multiplied by the ſaid quotient figure, and ſo continued to every new figure in the quotient.

(10) If the firſt root with its cyphers be more than juſt, the quotient muſt be ſubtracted from it; but if it be leſs than juſt, it muſt be added to it; and the ſum or difference will be the root required.

3. If an even power be given, and the ſquare-root of that power being extracted, reduce it to an odd power; you muſt then proceed with that odd power as the foregoing rules direct.

Examples.

1. What is the ſurſolid of 6436343?

6436343
32 the neareſt Surſolid, whoſe root and cypher is 20
3236343
The cube of 20 is = 8000
And 8000 × 5 is = 40000
Then 40000) 3236343(80 Laſtly 20
Again 2)80(3 + 3
+ 3 × 2 = 6 78
1ſt diviſor = 26 — 23 the ſurſolid
2 to be rejected. Root required.

*Note.* This is a very expeditious way of extracting the roots of high powers, but it is not always exact, becauſe, Mr. Ward obſerves, (for it was taken from him) there will be a remainder, and ſometimes an exceſs or defect in the laſt figure of the root when the given reſolvend or power hath a true root; as appears by the fifth example following, whoſe true root ſhould not be 384.3 as it there ſtands, but 3.84.

2. What is the ſurſolid of 48 ? *An.* 254830968.
3. What is the ſurſolid-root of 8153726976. ? *An.* 96.
4. What is the ſurſolid-root of 254803968. ? *An.* 48.
5. What is the ſurſolid-root of 8349416423424. ? *An* 3843

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## Of the SQUARE CUBE-ROOT.

Q. WHAT is a Square Cube?

A. Any number involved ſix times, produces a Square-Cube.

Examples.

1. What is the ſquare cube of 48 ? *An.* 12230590464
2. What is the ſquare cube-root of 782757789696. ? - - *An.* 96.
3. What is the ſquare cube-root of 12230590464. - - *An.* 48.
4. What is the ſquare cube-root of 3206175906594816. ? - - *An.* 384.

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## Of the SECOND SURSOLID ROOT.

Q. WHAT is the Second Surſolid?

A. Any number involved ſeven times produces a Second Surſolid.

EXAMPLES.

1. What is the ſecond-ſurſolid of 96. ? - - - *An.* 7514·747810816.
2. What is the ſecond ſurſolid-root of 7144747810816. ? - - - *An.* 96.
3. What is the ſecond ſurſolid-root of 587068342272. ? - - - *An.* 48.
4. What is the ſecond ſurſolid-root of 12311715481324093444. ? - - *An.* 384·43.

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## Of the SQUARE BIQUADRATE ROOT.

Q. WHAT is a Square Biquadrate?

A. Any number involved eight times, is a Biquadrate Squared, or Square-Biquadrate.

EXAMPLES

1. What is the ſquared Biquadrate of 48. ? - *An.* 28179280429056.

2. What is the ſquare biquadrate-root of 7213895789838336. ? - - } *An.* 96.

3. What is the ſquare biquadrate-root of 28179280429056. ? - - } *An.* 48.

4. What is the ſquare biquadrate-root of 472769874482845188096. ; } *An.* 384.

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## Of the CUBED CUBE-ROOT.

Q. WHAT is a Cubed Cube?

A. Any number involved nine times, is a Cubed Cube.

EXAMPLES.

1. What is the cubed cube-root of 692533995824480256. ? } *An.* 96.2

2. What is the cubed cube-root of 1352605460594683 ? } *An.* 48.09

3. What is the cubed cube-root of 181543631801412552228864. ? } *An.* 384.5

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## Of the SQUARE SURSOLID-ROOT.

Q. WHAT is a Squared Surſolid?

A. Any number involved ten times, produces a ſquared ſurſolid.

EXAMPLES.

1. What is the ſquared ſurſolid-root of 64925062108545024. - } *An.* 48.

2. What is the ſquared ſurſolid-root of 66483263599150104576. ? - } *An.* 96.

3. What is the ſquared ſurſolid-root of 69712754611742420055883776. } *An.* 384.3

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## Of the THIRD SURSOLID-ROOT.

Q. WHAT is a Third Surſolid?

A. Any number involved eleven times, produces a Third Surſolid.

Examples.

1. What is the third ſurſolid-root of 952809757913927. ? . - } *An.* 23.

2. What is the third ſurſolid-root of 3116402981210161152. ? } *An.* 48.

3. What is the third ſurſolid-root of 6382393305518410039296. ? } *An.* 96.

## Of the SQUARED SQUARE CUBE-ROOT.

Q. WHAT is a Squared Square-Cube?

A. Any number involved twelve times, produces a Squared Square-Cube.

Examples.

| | |
|---|---|
| 1. What is the root of this ſquared ſquare-cube 149587343098087735396.? | *An.* 48. |
| 2. What is the root of this ſquared ſquare-cube 612709757329767363772416.? | *An.* 96. |
| 3. What is the root of this ſquared ſquare-cube 1027956394402909029176039807385.? | *An.* 384. |

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## A General RULE for Extracting the ROOTS of all Powers.

1. PRepare the given number for Extraction by pointing off from the unity place, as the root required directs.

2. Find the firſt figure in the root by your own judgement, or by inſpection into the table of powers.

3. Subtract it from the given number.

4. Augment the remainder by the next figure in the given number, that is, by the firſt figure in the next point, and call this your dividend.

5. Involve the whole root, laſt found, into the next inferior power to that which is given.

6. Multiply it by the index of the given power, and call this your diviſor.

7. Find a quotient figure by common diviſion, and annex it to the root.

8. Involve all the root, thus found, into the given power.

9. Subtract this power (always) from as many points of the given power as you have brought down, beginning at the loweſt place.

10. To the remainder bring down the firſt figure of the next point for a new dividend.

11. Find a new diviſor as before, and in like manner proceed till the work is ended.

### EXAMPLES.

1. What is the Cube-Root of 115501303?

115501303(487
64

48)515 dividend

110592 ſubtrahend

6912)49093 dividend

115501303 ſubtrahend

0

$4 \times 4 \times 3 = 48$ diviſor
$48 \times 48 \times 48 = 110592$ ſubtrahend
$48 \times 48 \times 3 = 6912$ diviſor
$487 \times 487 \times 487 = 115501303$ ſubtrahend

2. What is the Biquadrate-root of 56249134561.?

56249134561.(487.
256

256)3064 dividend

5308416 ſubtrahend

442368)3164974 dividend

56249134561 ſubtrahend

0

$4 \times 4 \times 4 \times 4 = 156$ diviſor
$48 \times 48 \times 48 \times 48 = 5308416$ ſubtrahend
$48 \times 48 \times 48 \times 4 = 442368$ diviſor
$487 \times 487 \times 487 \times 487 = 56249134561$ ſubtrahend.

*Note*, This general rule I received from my worthy friend, William Mountaine, Eſq. F. R. S. and teacher of the Mathematics at Shad-Thames.

## Of SIMPLE INTEREST.

Q. WHAT particular letters are uſed here?

A. Theſe: P, any principal.
T, the time.
R, the ratio or the rate *per cent.*
A, the amount.

Q. What is the Ratio?

A. It ſignifies only the ſimple intereſt of 1l. for one year, at any propoſed rate of intereſt *per cent.* and is thus found:

100 : 6 : : 1 : 0.06
100 : 5 : : 1 : 0.05

*A Table of Ratios.*

| *Rate per cent.* | *Ratio.* | *Rate per cent.* | *Ratio.* |
|---|---|---|---|
| 2 | .02 | $6\frac{1}{2}$ | .065 |
| 3 | .03 | 7 | .07 |
| $3\frac{1}{2}$ | .035 | $7\frac{1}{2}$ | .075 |
| 4 | .04 | 8 | .08 |
| $4\frac{1}{2}$ | .045 | $8\frac{1}{2}$ | .085 |
| 5 | .05 | 9 | .09 |
| $5\frac{1}{2}$ | .055 | $9\frac{1}{2}$ | .095 |
| 6 | .06 | 10 | .1 |

### CASE I.

Q. When P, T, and R, are given to find A,—how is it diſcovered?

A. Thus, $ptr \times t = a$

Note, Any quantity of letters put together like a word, denotes continual multiplication.

### Examples.

1. What ſum will 567l. 10s. amount to in 9 years, at 6 *per cent. per annum*? *An.* £873 : 19s.

2. What will 508l. 14s. amount to in 1 year, at 5 *per cent. per annum*? *An.* £534 : 2 : 8 1.6 *qrs.*

3. What will 600l. 14s. amount to in 10 years, at $4\frac{1}{2}$ *per cent. per annum*? *An.* £871 : 0 : 3 2.4 *qrs.*

4. What will 4000l. amount to in 5 years, at $3\frac{1}{2}$ *per cent. per annum*? *An.* £4700.

Note, When the time given does not conſiſt of whole years, then reduce the odd time into decimal parts of a year. And, unleſs ſuch parts of a year chance to be juſt $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of a year, the beſt way will be to reduce the odd times into days, and then work with the decimal parts of a year, that are equivalent to thoſe days.

A TABLE *for the ready finding the* Decimal Parts *of a* Year, *equal to any number of* Days, *or* Quarters of a Year.

| *Days.* | *Decimal parts* | *Days.* | *Decimal parts* | *Days.* | *Decimal parts* |
|---|---|---|---|---|---|
| 1 | .00274 | 10 | .027397 | 100 | .273973 |
| 2 | .005479 | 20 | .054794 | 200 | .547945 |
| 3 | .008219 | 30 | .082192 | 300 | .821918 |
| 4 | .010959 | 40 | .109589 | 365 | 1.000000 |
| 5 | .013699 | 50 | .136986 | | |
| 6 | .016438 | 60 | .164383 | | |
| 7 | .019178 | 70 | .191781 | $\frac{1}{4}$ *of a year* | .25 |
| 8 | .021918 | 80 | .219178 | $\frac{1}{2}$ *of a year* | .5 |
| 9 | .024657 | 90 | .246575 | $\frac{3}{4}$ *of a year* | .75 |

*Note.* When the true number of days cannot be found at one view in this table, then both them and their decimals muſt be taken out of the table at twice or thrice, as their number requires, and added together. So the decimal parts of a year=236 days are thus found.

$$\begin{array}{r} 200=.547945 \\ 30=.082192 \\ 6=.016438 \\ \hline 236=.646575 \end{array}$$

Examples.

5. What will 7200l. amount to in 6½ years, at 5 *per cent. per annum*? *An.* £9540.

6. What will 1110l. 18s. amount to in 12¾ years at 5 *per cent per annum*? *Anſ.* £1819 : 1 : 11 : 2.8 *qrs.*

7. What will 280l. 10s. amount to in 3 years, and 148 days, at 5 *per cent. per annum*? *An.* £328 : 5 : 2 : 3.38+*qrs.*

8. What will 196l. amount to in 189 days, at 4 *per cent. per annum*? *An.* £200 : 1 : 2 : 1.23+*qrs.*

### CASE II.

Q. When A, T, and R, are given to find P;—how is it diſcovered?

A. Thus; $\frac{a}{tr+1}=p$.

Examples.

1. I demand what principal will amount to 873l. 19s. in 9 years, at 6 *per cent. per annum*? *Anſ.* £567 : 10*ſ.*

2. I demand what principal will amount to 534l. 2s. 8d. 1.6 qrs. in 1 year at 5 *per cent. per annum*? *Anſ.* £508 : 14*ſ.*

3. I demand what principal will amount to 9540l. in 6½ years, at 5 *per cent. per annum*? *Anſ.* £7200.

4. I demand what principal will amount to 1819l. 1s. 11d. 2.8 qrs. in 12¾ years, at 5 *per cent. per ann*? *Anſ.* £1110 : 18s.

5. I demand what principal will amount to 871l. 3d. 2.4 qrs. in 10 years, at 4½ *per cent. per ann*? *An.* £600 : 14*s.*

6. I demand what principal will amount to 4700l. in 5 years at 3½ *per cent. per ann*? *An.* £4000.

7. I demand what principal will amount to 328l. 5s. 2d. 3.38 qrs. in 3 years and 148 days, at 5 *per cent*? *An.* £280 : 10*s.*

8. What principal being put to intereſt for 189 days, at 4 *per cent.* will amount to 200l. 1s. 2½d? *An.* £196.

### Caſe III.

Q. When A, P, and T, are given to find R:—how is it diſcovered?

A. Thus; $\frac{a-p}{tp}=r$

### Examples.

1. At what rate *per cent.* will 567l. 10s. amount to 873l. 19s. in 9 years? *An.* £6 *per cent.*

2. At what rate *per cent.* will 508l. 14s. amount to 534l. 2s 8d. 1.6 qr. in one year? *An.* £5 *per cent.*

3. At what rate *per cent.* will 7200l. amount to 9540l. in 6½ years? *An.* £5 *per cent.*

4. At what rate *per cent.* will 1110l. 18s. amount to 1819l. 1s. 11d. 2.8 qrs. in 12¼ years? *An.* £5 *per cent.*

5. At what rate *per cent.* will 600l. 14s. amount to 871l. 3d. 2.4 qrs. in 10 years? *An.* 4½ *per cent.*

6. At what rate *per cent.* will 4000l. amount to 4700l in 5 years? *An.* 3½ *per cent.*

7. At what rate *per cent.* will 280l. 10s. amount to 328l. 5s. 2d. 3.38 qrs. in 3 years and 148 days? *An.* £5 *per cent.*

8. At what rate *per cent.* will 196l. amount to 200l. 1s. 2½d. in 189 days? *An.* 4 *per cent.*

### Caſe IV.

Q. When A, P, and R, are given to find T;—how is it diſcovered?

A. Thus; $\frac{a-p}{rp}=t.$

### Examples.

1. In what time will 567l. 10s. amount to 873l. 19s. at 6 *per cent*? *An.* 9 *years.*

2. In what time will 508l. 14s. amount to 534l. 2s. 8d. 1.6 qrs. at 5 *per cent*? *An.* 1 *year.*

3. In what time will 7200l. amount to 9540l. at 5 *per cent*? *An.* 6½ *years.*

4. In what time will 1110l. 18s. amount to 1819l. 1s. 11d. 2.8 qrs. at 5 *per cent*? *An.* $12\frac{3}{4}$ *years.*

5. In what time will 600l. 14s. amount to 871l. 3d. 2.4 qrs. at $4\frac{1}{2}$ *per cent*? *An.* 10 *years.*

6. In what time will 4000l. amount to 4700l. at $3\frac{1}{2}$ *per cent*? *An.* 5 *years.*

7. In what time will 280l. 10s. amount to 328l. 5s. 2d. 3.38 qrs. at 5 *per cent*? *An.* 3 *years and* 148 *days.*

8. In what time will 196l. amount to 200l. 1s. $2\frac{1}{2}$d. at 4 *per cent*? *An.* 189 *days.*

## *Of Annuities or Penſions in Arrears.*

*Q.* What is meant by Annuities or Penſions in Arrears?

A. Annuities or Penſions are ſaid to be in Arrears, when they are payable either yearly, half yearly, or quarterly, and are unpaid for any number of payments.

*Note,* U repreſents the annuity, penſion, &c. R, T, and A, as before.

### Caſe I.

Q. When U, R, and T, are given to find A, how is it diſcovered?

A. Thus; $\frac{tut - tu}{2} \times r : + tu = a.$

### Examples.

1. If an annuity of 70l. be forborne 5 years, what will it amount to in that time at 5 *per cent*? *An.* £385.

2. If the payment of a penſion be omitted for 7 years;—what will be the amount in that time at 6l. *per cent.* when the penſion is 56l. *per ann*? *An.* £462 : 11 : 2 : 1.6 *qrs.*

3. A houſe is let upon leaſe for 7 years, at 50l. *per ann*—I demand the amount for that time, at 4l. *per cent.* for the forbearance of payment? *An.* £392.

4. Suppoſe a ſalary of 100l. *per ann.* be forborne 7 years, what is the amount at $4\frac{1}{2}$ *per cent*? *An.* £794 : 10*s.*

*Note,* When the annuities or rents are to be paid by half-yearly or quarterly payments, as moſt generally they are, then,

For half-yearly payments take (always) half of the ratio, half of the yearly rent, and twice the number of years; that is, reduce the years into half years, for R, U, and T: But,

For quarterly payments, take a fourth part of the ratio, a fourth part of the yearly rent, and four times the number of years; that is, reduce the years into quarters and work as before.

5. If 70l. annuity, payable every half year, were unpaid 5 years;—what will it amount to in that time at 5 *per cent*? *An.* £389 : 7 : 6.

6. If 70l. annuity, payable every quarter, were unpaid 5 years, what will it amount to in that time at 5 *per cent* ?

*An.* £391 : 11 : 3.

*Note,* By comparing theſe two examples with the firſt, it may be obſerved that the amount of half yearly payments is more advantageous than yearly payments, and quarterly than half yearly payments.

## Caſe II.

Q. When A, R, and T, are given to find U ;—how is it diſcovered ?

A. Thus ; $\frac{2a}{trt-tr+2t}=u.$

### Examples.

1. If the amount of an annuity for 5 years at 5 *per cent.* be 385l—what is the annuity ? *An.* £70.

2. If the amount of a penſion be 462l. 11s. 2d. 1.6 qr. the time be 7 years, and the rate *per cent.* 6l—what is the penſion ? *An.* £56.

3. If a houſe be let upon leaſe for 7 years, and the amount for that time be 392l. at 4 *per cent*—what is the yearly rent? *An.* £50.

4. If a ſalary amount to 794l. 10s. in 7 years, at $4\frac{1}{2}$ *per cent.* what is the ſalary ? *An.* £100 *per ann.*

*Note,* When the payments are half-yearly, then take 4 *a*, and half of the ratio, and twice the number of years; and if quarterly, then take 8 *a*, one fourth of the ratio, and four times the number of years, and proceed as before.

5. If the amount of an annuity, payable half-yearly, for 5 yrs. at 5 *per cent.* be 389l. 7s. 6d—what is the annuity ? *An.* £70.

6. If the amount of an annuity, payable quarterly, for 5 yrs. at 5 *per cent.* be 391l. 11s. 3d—what is the annuity ? *An.* £70.

## Caſe III.

Q. When U, A, and T, are given to find R ;—how is it diſcovered ?

A. Thus ; $\frac{2a-2ut}{utt-ut}=r$

### Examples.

1. If an annuity of 70l. *per ann.* amounts to 385l. in 5 years ;—I demand the rate *per cent* ? *An.* £5.

2. If a penſion of 56l. *per ann.* amounts to 462l. 11s. 2d. 1.6 qrs. in 7 years ;—what is the rate *per cent* ? *An.* £6.

3. If a houſe be let upon leaſe for 7 years, at 50l. *per ann.* and the amount for that time be 392l—what is the rate *per cent* ? *An.* £4 *per cent.*

4. If a ſalary of 100l. *per ann.* being forborne 7 years amounts to 794l. 10s—I demand the rate *per cent* ? *An.* £ $4\frac{1}{2}$

*Note,* When the payments are half-yearly, take $4a-4ut$ for a dividend, and work with half the annuity, and double the number of years for a diviſor; if quarterly, take $8a-8ut$ and work with a fourth of the annuity, and four times the number of years.

5. If an annuity of 70l *per annum* payable half-yearly, being forborne 5 years, amounts to 389l 7s. 6d—I demand the rate *per cent*? *An.* £5 *per cent.*

6. If an annuity of 70l. *per ann.* payable quarterly, amounts to 391l. 11s. 3d. in 5 years;—I demand the rate *per cent*? *An.* £5 *per cent.*

Caſe IV——Q. When U, A, and R, are given to find T:—how is it diſcovered?

A. Thus; Firſt $\frac{2}{r} - 1 = x.$

Secondly, $\sqrt{\frac{2r}{ru} + \frac{xx}{4}} :- \frac{1}{2}x = t.$

### Examples.

1. In what time will 70l. *per annum* amount to 385l. forborne at 5 *per cent*? *An.* 5 *years.*

2. In what time will a penſion of 56l. *per ann.* amount to 461l. 11s. 2d. 1.6 qr. at 6 *per cent*? *An.* 7 *years.*

3. If a houſe be let upon leaſe, for a certain time, for 50l. *per annum* and the amount be 392l. at 4 *per cent*—I demand the time that it was let for? *An.* 7 *years.*

4. If a ſalary of 100l *per annum* being forborne a certain time amounts to 794l. 10s. at 4½ *per cent*—I demand the time of forbearance? *An.* 7 *years.*

*Note,* If the payments were half-yearly, then T will be equal to the number of half-years, or payments; but if they were to be made quarterly, then T will be equal to the number of quarterly payments.

5. If an annuity of 70l *per ann.* payable half yearly, being forborne, amounts to 389l 7s. 6d. at 5 *per cent*—I demand the time and payments forborne? *An.* 10 *payments* = 5 *years.*

6. If an annuity of 70l. *per ann.* payable quarterly, being forborne, amounts to 391l. 11s. 3d. at 5 *per cent*—I demand the time and payments forborne? *An.* 20 *payments* = 5 *years.*

## *Of the Preſent Worth of Annuities or Penſions, &c.*

*Note,* P repreſents the preſent worth; U, T, and R, as in the laſt.

### Caſe I.

Q. When U, T, and R, are given to find P;—how is it diſcovered?

A. thus; $\frac{rtt - rt + 2t}{2rt + 2} \times u = p,$

### EXAMPLES.

1. What is the preſent worth of 50l. *per annum* to continue 6 years, at 5 *per cent?* *An.* 259 : 12 : 3 : 2.4+*qrs.*

2. What is 80l. yearly rent, to continue 5 years, worth in ready money, at ſix *per cent?* *An.* 344 : 12 : 3 : 2.5+*qrs.*

3. What is a ſalary of 40l. *per annum* to continue 7 years, worth in ready money, at 4 *per cent?* *An.* £245.

4. What is a penſion of 30l. *per ann.* for 5 years, worth in ready money, at 4½ *per cent?* *An.* £133 : 9 : 4 : 2.6+*qrs.*

*Note,* Obſerve the ſame note here, which is given in Caſe I. in annuities and penſions in arrears, concerning half-yearly and quarterly payments.

5. What is the preſent worth of 50l. *per ann.* payable half-yearly for 6 years, at 5 *per cent?* *An.* £262 : 10*s.*

6. What is the preſent worth of 50l. *per ann.* payable quarterly for 6 years, at 5 *per cent?* *An.* £263 : 18 : 9 : 3.6 *qrs.*

### Caſe II.

Q. When P, T, and R, are given to find U;—how is it diſcovered?

A. Thus;

$$\frac{rt+1}{rtt-rt+2t} \times 2p = u.$$

### Examples.

1. There is a leaſe of a houſe 6 years to come; I demand the yearly rent, when the preſent worth, at 5 *per cent.* is 259l. 12s. 3d. 2 qrs? *An.* £50 *per ann.*

2. What yearly rent is that, the preſent worth of which for 5 years is 344l. 12s. 3d. 2 qrs. at 6 *per cent?* *An.* £80 *per ann.*

3. What ſalary is that which for 7 years continuance at 4 *per cent* produces 245l. for the preſent worth? *An.* £40 *per ann.*

4. If the preſent worth of a penſion to continue 5 years at 4½ *per cent.* be 133l. 9s. 4d. 3 qrs—I demand the penſion? *An.* £30.

*Note,* When the payments are half-yearly, take half of the ratio, twice the number of years, and multiply by 4 *p*; and when quarterly, take one fourth of the ratio, four times the number of years, and multiply by 8*p.*

5. There is a leaſe of a houſe, payable half yearly, for 6 years to come—I demand the yearly rent, when the preſent worth at 5 *per cent.* is 262l. 10s? *An.* £50.

6. There is a leaſe of a houſe, payable quarterly, for 6 years to come;—I demand the yearly rent, when the preſent worth at 5 *per cent.* is 263l. 18s. 9d. 3.6 qrs? *An.* £50.

### Caſe III.

Q. When U, P, and T, are given to find R;—how is it diſcovered?

*A.* Thus; $\frac{2ut - 2p.}{2pt - utt - ut} = r.$

### EXAMPLES.

1. I demand at what rate *per cent.* will the yearly rent of 50l. to continue 6 years, produce the preſent worth of 259l. 12s. 3d. 2 qrs? *Anſ.* £ 5 *per cent.*

2. If the yearly rent of 80l. *per ann.* to continue 5 years, bring 344l. 12s. 3d. 2 qrs. preſent worth;—what is the rate *per cent?* *Anſ.* £6 *per cent.*

3. If a ſalary of 40l. *per ann.* to continue 7 years, produce 245l. for the preſent worth;—what is the rate *per cent?* *Anſ.* £4 *per cent.*

4. If a penſion of 30l. *per ann.* to continue 5 years, produce 133l. 9s. 4d. 2 qrs. for the preſent worth;—what is the rate *per cent.* *Anſ* £$4\frac{1}{2}$ *per cent.*

*Note,* When the annuities or rents, are to be paid half-yearly or quarterly, then,

For half-yearly payments, take half of the annuity, or yearly rent, and twice the number of years, that is, reduce the years into half years, and then the quotient of the upper part, divided by the lower, will be the ratio of half the rate *per cent.* But,

For quarterly payments, take a fourth part of the annuity, or yearly rent, and four times the number of years; that is, reduce the years into quarters, and then the quotient of the upper part divided by the lower, will be the ratio of a fourth part of the rate *per cent.*

5. A leaſe of a houſe of 50l. *per ann.* payable half-yearly, having 6 years to come, is ſold for 262l. 10s.—I demand the rate *per cent* *Anſ.* £ 5 *per cent.*

6. A leaſe of a houſe of 50l. *per ann.* payable quarterly, having 6 years to come, is ſold for 263l. 18s. 9d. 3 qrs — I demand the rate *per cent?* *Anſ.* £ 5 *per cent.*

### CASE IV.

*Q.* When U, P, and R, are given to find T;—how is it diſcovered?

A. Thus; Firſt, $\frac{2}{r} - \frac{2p.}{u} - 1 = x.$

Secondly, $\sqrt{\frac{2p}{ru} + \frac{xx}{4}} - \frac{x}{2} = t.$

### EXAMPLES.

1. If 50l. yearly rent produce the preſent worth of 259l. 12s. 3d. 2 qrs. at 5 *per cent.*—what is the time of its continuance? *Anſ.* 6 *years.*

2. I demand how long 80l. *per ann.* may be purchaſed for 344l. 12s. 3d. 2 qrs. at 6 *per cent* *Anſ* 5 *years.*

3. How long muſt a ſalary of 40l. *per ann.* be enjoyed for 524l. at 4 *per cent?* *Anſ.* 7 *years.*

4. What time may a penſion of 30l. *per ann.* be bought for 133l. 9s. 4d. 2 qrs. at $4\frac{1}{2}$ *per cent ?* *Anſ. 5 years.*

*Note* 1. If the payments are to be half yearly, then U will be = half of the given leaſe, penſion, &c. and R will be = a half of the ratio of the given rate, and T, which is required, will be = the number of payments or half years.

2. If the payments are to be quarterly, then U will be = a fourth part of the given leaſe, penſion, &c. and R will be = a fourth part of the ratio of the given rate, and T will be = the number of quarterly payments.

5. A leaſe of a houſe of 50l. *per ann.* payable half-yearly, is ſold for 262l. 10s. at 5 *per cent.*—I demand the number of payments, and the time to come ? *Anſ.* 12 *payments* = 6 *years.*

6. A leaſe of a houſe of 50l *per ann.* payable quarterly, is ſold for 263l. 18s 9d. 3 qrs. at 5 *per cent.*—I demand the number of payments, and the time to come ?

*Anſ.* 24 *payments* = 6 *years.*

### *Of Annuities, Leaſes, &c. taken in Reverſion.*

### CASE I.

Q. How do you find the preſent worth of an annuity, in reverſion ?

A. Thus ; Firſt find the preſent worth of the yearly ſum, at the given rate and for the time of its continuance ;—to do which there are given U, T, and R, to find P which is thus diſcovered :

$$\frac{rtt - rt + 2t}{2rt + 2} \times u = p$$

Secondly, Find what principal being put to intereſt will amount to P, at the ſame rate, and for the time to come before the annuity, &c commences, and that will be the preſent worth of the annuity, &c. in reverſion : Therefore let P be changed into A = the amount, and then there will be given A, R, and T, to find P, or the principal, which is thus diſcovered;

$$\frac{a}{tr + 1} = p.$$

### EXAMPLES.

1. What is the preſent worth of a leaſe of 30l *per ann.* to continue 3 years ;—but is not to commence till the end of 2 years, allowing 4 *per ct.* to the purchaſer? *An* £77 : 7 : 7.4*d.*

2. I have the promiſe of a penſion of 17l. *per ann.* for 7 yrs. but it does not commence till the end of 4 years, and I am willing to diſpoſe of the ſame for the preſent payment, at the rate of 5 *per cent.*—I demand the preſent worth ? *An.* £84 : 9 : 6.

3. There is a legacy of 20l. *per ann.* for 8 years, left to a perſon of 16 years of age ; the time of payment is to commence at the year of perfection, *i e.* at 21 years ; but he want-

ing a ſum of money, is minded to ſell the ſame at 4 *per cent.* I demand the preſent worth? *Anſ.* £115 : 3 : 0 : 1.44 *qr.*

A good-natured gentleman being minded to beſtow a favour upon an unthankful wretch, ſettled upon him an income of 35l. *per ann.* for 12 years, to commence 5 years after ſuch ſettlement; but he wanting money to follow his extravagances, ſold it at the rate of 10 *per cent.*—I demand how much he received for the preſent worth? *An.* £197 : 5 : 5 : 1.792 *qr.*

### CASE IV.

Q. How do you find the yearly income of an annuity, &c. in reverſion?

A. Thus; Firſt find the amount of the preſent worth of the yearly ſum, at the given rate, and for the time before the reverſion; to do which, there are given P, T, and R, to find A, which is thus diſcovered: $ptr+p=a$

Secondly, Find what yearly rent being ſold, will produce A, for the preſent worth, at the ſame rate, and for the time of its continuance; and that will be the yearly ſum required: Therefore change A into P, and then there will be given P, R, and T, to find U, or the yearly ſum thus:

$$\frac{rt+1}{rt-rtt+2t} \times 2p=u$$

### EXAMPLES.

1. There is a leaſe of a houſe taken for 3 years, but commences not till the end of 2 years; and the leſſee would ſell the ſame for 77l. 7s. 7.2d. preſent payment, allowing 4 *per cent.* to the purchaſer;—I demand the yearly rent? *Anſ* £30 *per ann.*

2. I have the promiſe of a penſion for 7 years, which will not commence till the end of 4 years; and I have diſpoſed of the ſame for the preſent payment of 84l. 9s. 6d. allowing 5 *per cent.* to the purchaſer; I demand the yearly income? *Anſ.* £ 17.

3. There is a legacy of a certain rate *per ann.* for 8 years left to a perſon of 16 years of age; but the time of payment muſt not commence till the age of perfection; and the ſame perſon wanting a ſum of money, ſold it for 115l. 3s 2qrs. allowing 4 *per cent.* to the buyer;—I demand the yearly rate? *Anſ.* £20.

4. A good natured gentleman, being minded to beſtow a favour upon an unthankful wretch, ſettled an income upon him for 12 years, at a certain rate *per ann.* to commence 5 years after ſuch ſettlement; but he wanting money to follow his extravagance, ſold it for 197l. 5s. 5d. 2 qrs. allowing 10 *per cent.* to the buyer for preſent payment;—I demand the yearly value? *Anſ.* £35.

## *Of Simple Intereſt for Days.*

Q. How do you find the ſimple Intereſt of any ſum of money for any number of days?

A Multiply the intereſt of one pound for one day, at the given rate, by the principal, and by the number of days; the laſt product is the intereſt required.

*Note*, The intereſt of one pound for one day at

| | | |
|---|---|---|
| 1 | | is=.00002739726 |
| 2 | | is=.00005479452 |
| 3 | | is=.00008219178 |
| 4 | | is=.00010958904 |
| 5 | *per cent.* | is=.00013698630 |
| 6 | | is=.00016438356 |
| 7 | | is=.00019178082 |
| 8 | | is=.00021917808 |
| 9 | | is=.00024657534 |
| 10 | | is=.0002739726 |

### EXAMPLES.

1. What is the intereſt of 120l. for 126 days, at 4 *per cent?*
*Anſ.* £1 : 13 : 1 : 2 *qrs.*+

2. What is the intereſt of 126l. for 145 days, at 6 *per cent?*
*Anſ.* £3 : 0 : 0 3 *qrs.*+

3. What is the intereſt of 100l. from the 1ſt of June, 1793. to the 8th of March following, at 5 *per cent.*?
*Anſ.* £3 : 16 : 11 : 3 *qrs.*

4. What is the intereſt of 200l. from the 14th of Auguſt, 1793, to the 19th of December following, at 6 *per cent.*?
*Anſ.* £4 : 4 : 1 : 3 *qrs.*+

5. What is the intereſt of 10l. for 25 days, at 5 *per cent.*?
*Anſ.* 8*d.*+

6. What is the intereſt of 40l. for 40 days, at 4 *per cent.*?
*Anſ.* 3*s.* 6*d.*+

*Note*, There is another way of anſwering queſtions in intereſt for days, which is laid down in Caſe I. in Simple Intereſt, page 132, as appears by the eight queſtions in that caſe. The reader may uſe which he likes beſt, or both if he pleaſes.

## *Of Rebate or Diſcount.*

**Q.** What particular Letters are uſed in Rebate?

**A.** Theſe:

S, the ſum to be diſcounted.
P, the preſent worth of that ſum, due at any time to come
T, the time before it becomes due.
R, the ratio, or the rate *per cent.*

### CASE I.

Q. When S, T, and R, are given to find P;—how is it diſcovered?

A. Thus; $\frac{s}{tr+1}=p$.

### EXAMPLES.

1. What is the preſent worth of 795l. 11s. 2d. for 11 months, at 6 *per cent.* ? *An* £754 : 1 : 8*d.* +

2. What is the preſent worth of 161l. 10s. for 19 months, at 5 *per cent.* *Anſ.* £149 : 13 : 0 : 3 *qrs.* +

3. If a legacy of 1000l. is left me the 24th of July, 1793, to be paid on the Chriſtmas day following; what muſt I receive when I allow 6 *per cent.* for preſent payment ? *Anſ.* £975 : 3 : 0 : 3 *qrs.* +

### CASE II

Q. When P, T, and R, are given to find S; how is it diſcovered ?

*A.* Thus; $ptr + p = s$.

### Examples.

1. Suppoſe I receive 754l. 1s. 8d. now, for a ſum of money due 11 months hence, allowing 6 *per cent.* for preſent payment; I demand the ſum that was due at firſt ? *Anſ.* £795 : 11 : 2.

2. There is a certain debt, payable 19 months hence, but I agree with the debtor to pay me down 149l. 13s. 0$\frac{1}{4}$d, and allow him 5 *per cent.* for preſent payment; I demand how much the debt is ? *Anſ.* £161 : 10.

3. A legacy was left me the 24th of July, 1793, to be paid on Chriſtmas-day following, but I agree with the executor, and allow him 6 *per cent.* for the preſent payment of 975l. 3s. 3 qrs.; I demand what the legacy was ? *Anſ.* £1000.

### CASE III.

Q. When S, P, and R, are given to find T; how is it diſcovered ?

*A.* Thus; $\frac{s-p}{rp} = t$.

### Examples

1. The preſent worth of 795l. 11s. 2d. due for a certain time to come, is 754l. 1s. 8d. at 6 *per cent.*; I demand in what time the firſt ſum ſhould have been paid, if no rebate had been made? *Anſ.* 11 *months.*

2. There is 161l. 10s. due at a certain time to come, but I allow 5 *per cent.* to the debtor, for the preſent payment of 149l. 13s. 3 qrs; I demand when the ſum ſhould have been paid without any rebate ? *Anſ.* 19 *months.*

3. I have received 975l. 3s. 3 qrs. for a legacy of 1000l. allowing the executor 6 *per cent.*; I demand when the legacy was payable without rebate ? *Anſ.* 155 *days.*

### Caſe IV.

Q. When S, P, and T, are given to find R; how is it diſcovered ?

A. Thus; $\frac{s-p}{tp} = r$.

Examples.

1. At what rate *per cent.* will 795l. 11s. 2d. payable 11 months hence, produce 754l. 1s. 8d. for preſent payment?

*An.* 6 *per cent.*

2. At what rate *per cent.* will 161l. 10s. payable 19 months hence, produce the preſent payment of 149l 13s. 3 qrs?

*An.* 5 *per cent.*

3. Suppoſe a legacy of 1000 l is left me the 24th of July, 1793, to be paid on the Chriſtmas day following; —but I agree with the executor for the preſent payment of 975l. 3s. 3 qrs —I demand the rate *per cent.* allowed for his money?

*An* 6 *per cent.*

### *Of Equation of Payments (the true Way.)*

Q. How is the equated time for the payment of a ſum of money, due at ſeveral times, found out?

A. Thus, *Firſt*. Find the preſent worth of each payment for its reſpective time, as in Rebate, that is;

$$\frac{s}{tr+1} = p$$

2. Add all the preſent worths together, and call that ſum alſo P; then is $s-p=d$ the rebate

3. $\frac{d}{pr} = e$ is the true equated time.

Examples.

1. A owes B 200l to be paid as follows, viz. 100l. at 2 months, and 100l at 4 months; but they agree to have but one payment of the whole, rebate being made at 6 *per cent.* I demand the equated time? *Anſ* 3 *months.*

2. A merchant hath owing him 300l. to be paid as follows; 50l. at two months, 100l at 5 months, and the reſt at 8 months; and it is agreed to have but one payment of the whole, rebate being made at 5 *per cent.* I demand the equated time?

*Anſ.* 5.9796 *months.*

3. F owes to H 1000l whereof 200l. is to be paid preſent, 400l. at 5 months, and the reſt at 10 months; but they agree to have but one payment of the whole, at the rate of 4 *per cent.* rebate; I demand the true equated time? *An.* 181 *days.*

4. A man owes a merchant 1200l, to be paid as follows: 200l. down, 500l. at the end of 10 months, and the reſt at the end of 20 months; and they agree to have but one payment of the whole, rebate at 3 *per cent.* I demand the true equated time? *An.* 1 *year,* 11 *days.*

## Of COMPOUND INTEREST.

Q. WHAT particular letters are uſed here?

A. Theſe.

P, the principal.

T, the time.

R, the amount of 1l. for 1 year, at any given rate.

A, the whole amount.

Q. How is the amount of 1l. for 1 year, at any propoſed rate *per cent.* found?

A. Thus; As 100 : 106 : : 1 : 1.06

100 : 105 : : 1 : 1.05

A *Table of the* Amounts of *1l. for One Year.*

| *Rates per cent.* | *Amts. of 1l.* | *Rates per Ct.* | *Amts. of 1l.* |
|---|---|---|---|
| 2 | 1.02 | 6½ | 1.065 |
| 3 | 1.03 | 7 | 1.07 |
| 3½ | 1.035 | 7½ | 1.075 |
| 4 | 1.04 | 8 | 1.08 |
| 4½ | 1.045 | 8½ | 1.085 |
| 5 | 1.05 | 9 | 1.09 |
| 5½ | 1.055 | 9½ | 1.095 |
| 6 | 1.06 | 10 | 1.1 |

### Caſe I.

Q. When P, T, and R, are given to find A;—how is it diſcovered?

A. Thus; $p \times r^t = a$.

*Note,* R muſt be involved ſo many times as the number of years direct, and that will be $r^t$.

### EXAMPLES.

1. What ſum will 450l. amount to in 3 years time, at 5 *per cent. per annum?* *An.* £520 : 18 : 7 : 2 *qrs.*

2. What will 400l. amount to in 4 years, at 6 *per cent per annum?* *An.* £504 : 19 : 9 : 3.15264 *qrs.*

3. What will 480l. amount to in 6 years, at 5 *per cent. per annum?* *An.* £643 : 4 : 11.0178*d.*

4. What is the amount of 500l. at 4¼ *per cent. per ann.* for 4 years? *An.* £590 : 11 : 5 : 2.95+*qrs.*

### Caſe II.

Q. When A, R, and T, are given to find P;—how is it diſcovered?

A. Thus; $\frac{a}{r^t} = p$

### EXAMPLES.

1. What principal muſt be put to intereſt, to amount to the ſum of 520l. 18s. 7d. 2 qrs. in 3 years, at 5 *per cent. per ann.*? *An.* £450.

2. What principal will amount to 504l. 19s. 9d. 3.15264 qrs in 4 years at 6 *per cent. per ann.*? *Anſ.* £400.

3. What principal will amount to 643l. 4s. 11.0178d. in 6 years, at 5 *per cent per ann.*? *Anſ.* £480.

4. What principal will amount to 590l. 11s. 5d. 3 qrs, in 4 years, at 4¼ *per cent*? *Anſ.* £500l.

### Caſe III.

Q. When P, R, and A are given to find T;—how is it diſcovered?

A. Thus; $\frac{a}{p}=r^{t}$ which being continually divided by *r*, till nothing remains, the number of thoſe diviſions will be $=t$.

### Examples.

1. In what time will 450l. amount to 520l. 18s. 7d. 2 qrs. at 5 *per cent. per ann*? *An.* 3 *years.*

2. In what time will 400l. amount to 504l. 19s. 9d. 3.2 qrs. at 6 *per cent per ann*? *An* 4 *years.*

3. In what time will 480l. amount to 643l. 14s. 11.1d. at 5 *per cent. per ann*? *An.* 6 *years.*

4. In what time will 500l. amount to 590l. 11s. 5d. 3 qrs. at 4½ *per cent. per ann*? *An.* 4 *years.*

### Caſe IV.

Q. When P, A, and T, are given to find R;—how is it diſcovered?

A. Thus; $\frac{a}{p}=r^{t}$ which muſt be extracted by the rules of extraction; the time given in the queſtion $=t$, ſhewing the power.

### EXAMPLES.

1. At what rate *per cent.* will 450l. amount to 520l. 18s. 7d. 2 qrs. in 3 years? *An.* 5 *per cent.*

2. At what rate *per cent.* will 400l. amount to 504l. 19s. 9d. 3.2 qrs. in 4 years? *An.* 6 *per cent.*

3. At what rate *per cent.* will 480l. amount to 643l. 4s. 11.1d. in 6 years? *An.* 5 *per cent.*

4. At what rate *per cent.* will 500l. amount to 590l. 11s. 5d. 3 qrs. in 4 years? *An.* 4½ *per cent.*

## *Of Annuities or Penſions in Arrears.*

### Caſe I.

*Note*, U repreſents the annuity, penſion, &c. T, R, and A, as before.

*Q.* When U, T, and R, are given to find A;—how is it diſcovered?

A. Thus; $\frac{ur^t - u}{r - 1} = a$.

### Examples.

1. What will an annuity of 30l. *per ann.* payable yearly, amount to in 4 years at 5 *per cent*? *An.* £129 : 6 : 0 : 3.6 *qrs.*

2. Suppoſe a penſion of 50l. *per ann.* payable yearly, be granted to a ſuperannuated officer;—what is the amount for 5 years forbearance at 4 *per cent*? *An.* £270 : 16 : 3 : 3.4 + *qrs.*

3. If the yearly rent of a houſe which is 40l. be forborne 7 years, at 6 *per cent*—what is the amount?

*An.* £335 : 15 : 3.3 + *qrs.*

4. If a ſalary of 35l. *per ann.* to be paid yearly be omitted for 6 years, at 5½ *per cent*—what is the amount?

*An.* £241 : 1 : 7 : 2.5 + *qrs.*

### Caſe II.

Q. When R, T, and A, are given to find U;—how is it diſcovered?

A. Thus; $\frac{ra - a}{r^t - 1} = u$.

### Examples.

1. What annuity, being forborne for 4 years, will amount to 129l 6s. 1d. at 5 *per cent*? *An.* £30 *per ann.*

2. If a penſion being forborne for 5 years, at 4 *per cent. per ann* amounts to 270l. 16s. 4d—I demand how much it is *per ann*? *An.* 50 *per ann.*

3. If the yearly rent of a houſe, being forborne for 7 years, at 6 *per cent.* amounts to 335l. 15s. 0d. 3.4 qrs—I demand what the rent is? *An* £40 *per ann.*

4. If the payment of a ſalary be omitted 6 years;—I demand how much the ſalary is, when the amount is 241l. 1s. 7d. 2.6 qrs. at 5½ *per cent*? *An.* £35 *per ann.*

### Caſe IV.

Q. When U, A, and R, are given to find T;—how is it diſcovered?

A. Thus; $\frac{ar + u - a}{u} = r^t$ which being continually divided by *r*, till nothing remains, the number of thoſe diviſions will be $= t$.

## EXAMPLES.

1. In what time will 30l. *per ann.* amount to 129l. 6s. 1d. allowing 5 *per cent.* for the forbearance of payment?
*An.* 4 *years.*

2. In what time will a penſion of 50l. *per ann.* amount to 270l. 16s. 4d. at 4 *per cent*? *An.* 5 *years.*

3. In what time will the yearly rent of a houſe, being 40l. *per ann.* amount to 335l. 15s. 1d. at 6 *per cent.* for non-payment? *An.* 7 *years.*

4. In what time will a ſalary of 35l. *per ann.* amount to 241l. 1s. 7d. 2.6 qrs. at $5\frac{1}{2}$ *per cent.* for the forbearance of payment? *An.* 6 *years.*

*Note,* In this and the two next Sections might be placed Caſe IV. but becauſe it requires an Algebraic method of proceeding in order to find R, I omit inſerting it in its place; this being deſigned to treat only of numbers.

### *Of the preſent Worth of Annuities, Penſions, &c.*

*Note,* P is the preſent worth, U, T, and R, as in the laſt.

### Caſe I.

*Q.* When U, T, and R, are given to find P; how is it diſcovered?

A. Thus; $$\frac{u - \frac{u}{r^t}}{r - 1} = p.$$

Examples.

1. What is the yearly rent of 20l. to continue 6 years, worth in ready money, at 5 *per cent*? *An.* £101 : 10 : 3 : 3 *qrs.*

2. What is the preſent worth of a penſion of 30l. *per ann.* for 5 years, at 4 *per cent*? *An.* £133 : 11 : 1.

3. What muſt be the diſcount of a leaſe of 50l. *per ann.* when preſent payment is made for 4 years, at 3 *per cent*?
*An.* £14 : 2 : 10.2 *qrs.*

4. A houſe is let upon leaſe for 4 years, at 70l. *per ann.* and the leſſee is deſirous to make preſent payment, provided the leſſor will allow him $5\frac{3}{4}$ *per cent*—I demand how much muſt be paid down, and how much diſcounted?

*An.* { £243 : 19 : 0 : 3 *qrs. to be paid down.*
36 : 0 : 11 : 1 *qr. to be diſcounted.*

### Caſe II.

*Q.* When P, T, and R, are given to find U;—how is it diſcovered?

A. Thus; $$\frac{pr^t \times r - pr^t}{r^t - 1} = u$$

EXAMPLES.

1. What annuity or yearly rent to continue 6 years, may be purchaſed for 101l. 10s 3d. 3 qrs. at 5 *per cent*? *Anſ.* £20.

2 Suppoſe the preſent payment of 133l. 11s. 1d. were required for a penſion for 5 years to come, at 4 *per cent.* what is that penſion? *Anſ.* £30 *per ann.*

3. If the preſent payment of 185l. 17s. 1d. 2 qrs. be made for the leaſe of a houſe, 4 years to come, at 3 *per cent.*—what is the yearly rent? *Anſ.* £50 *per ann.*

4 If a houſe is let upon leaſe for 4 years, and the leſſee makes preſent payment of 243l. 19s. 3 qrs. for that time, at $5\frac{1}{4}$ *per cent.*—what is the yearly rent of the houſe?

*Anſ.* £ 70 *per ann.*

CASE III.——Q. When U, P, and R, are given to find T;—how is it diſcovered?

A. Thus; $\frac{u}{p+u-pr}=r^t$ which being continually divided by $r$, till nothing remains, the number of thoſe diviſions will be $=t$.

1. How long may a leaſe of 20l. yearly rent, be had for 101l. 10s. 3d. 3 qrs. allowing 5 *per cent* to the purchaſer?

*Anſ.* 6 *years.*

2. I demand what time a leaſe of 30l. *per ann.* may be purchaſed for; when preſent payment of 133l. 11s. 1d. is made at 4 *per cent*? *Anſ.* 5 *years.*

3. If 185l. 17s. 1d. 2 qrs. be paid down for a leaſe of 50l. *per ann* at 3 *per cent.*—how long is the leaſe purchaſed for?

*Anſ* 4 *years.*

4. A houſe is let upon leaſe at 70l. *per ann.* and the leſſee makes preſent payment of 243l. 19s. 3 qrs. he being allowed $5\frac{3}{4}$ *per cent.*—I demand how long the leaſe is purchaſed for?

*An.* 4 *years.*

### *Of Annuities, Leaſes, &c. taken in Reverſion.*

CASE I—Q. How many operations are there in Caſe I.?

A. Two.

Q What is the firſt.

A. Find the preſent worth of the yearly ſum at the given rate, and for the given time of its continuance; to do which there are given U, T, and R, to find P.

Q How is P diſcovered?

A. Thus; $\frac{u-\frac{u}{r^t}}{r-1}=p.$

Q. What is the ſecond ?

A. Find what principal being put to intereſt will amount to P, at the ſame rate, and for the time to come before the annuity commences, and that will be the preſent worth of the annuity, *&c*, in reverſion ; therefore let P be changed into A=the amount, and then there will be given A, R, and T, to find P, or the principal.

Q. How is P diſcovered ?

A. Thus ; $\frac{a}{r^t}=p$,

### Examples.

1. What is the preſent worth of the reverſion of a leaſe of 20l. *per ann.* to continue 4 years, but not to commence till the end of two years, allowing 5 *per cent* to the purchaſer ?

*Anſ* £64 : 6 : 6 : 1.4+*qrs.*

2. There is a leaſe of certain lands, worth 32l. *per ann.* which is yet in being for 4 years, and the leſſee is deſirous to take a leaſe in reverſion for 7 years, to begin when the old leaſe ſhall be expired ;—I demand the preſent worth of the ſaid leaſe in reverſion, allowing 5 *per cent* to the purchaſer ?

*Anſ.* £152 : 6 : 8 : 2*qrs.*+

3. There is a houſe now building, which I have a mind to take a leaſe of for 8 years, but the houſe will not be finiſhed within 2 years ; – I demand how much I muſt pay down, when the yearly rent is 100l. and the landlord allows me 4 *per cent* on preſent payment ? *Anſ.* £622 : 9 : 7.2*d.*

### CASE II.

Q How many operations are there in Caſe II. ?

A. Two.

Q. What is the Firſt ?

A. Find the amount of the preſent worth of the yearly ſum at the given *rate*, and for the time before the annuity commences, to do which there are given P, R, and T, to find A.

Q. How is A diſcovered ?

A. Thus ; $pr^t = a$

Q. What is the ſecond ?

A. Find what yearly rent being ſold will produce A for the preſent worth, at the ſame rate, and for the time of its continuance, and that will be the yearly ſum required : Therefore, let A be changed into P, and then there will be given P, R, and T, to find U, or the yearly ſum.

Q. How is U diſcovered?

A. Thus; $\frac{pr^t \times r - pr^t}{r^t - 1} = u.$

### Examples.

1. What annuity or yearly rent to be entered upon 2 years hence, and then to continue 4 years, may be purchaſed for 64l. 6s. 6d. 2 qrs. ready money, at 5 *per cent?* *An.* £20.

2. There is a leaſe of certain lands in being for 4 years, and the leſſee being minded to take a leaſe in reverſion for 7 years, to begin when the old leaſe ſhall be expired, laid down 152l. 6s 8d. 2 qrs—I demand the yearly rent of the ſaid lands, when allowance was made to the leſſee at 5 *per cent?* *An.* £32 *per ann.*

3. The preſent payment for the leaſe of a houſe is 622l. 9s. 7.2d. Now I have taken a leaſe in reverſion for 8 years, which is to commence at the end of two years;—I demand how much the yearly rent is, when for the ſaid preſent payment I was allowed 4l. *per cent?* *An.* £100 *per ann.*

### CASE III.

Q. How many Operations are there in Caſe III?

A. Two.

Q What is the firſt?

A Find what amount of the preſent worth of the yearly ſum at the given rate, and for the time before the annuity, *&c.* commences; to do which there are given P, R, and T, to find A, as in Caſe II.

Q How is A diſcovered?

A Thus; $pr^t = a$

Q What is the ſecond Operation?

A. Find what time the yearly rent given, being ſold for will produce A for the preſent worth, at the ſame rate, and that will be the time required: Therefore change A into P, and then there will be given U, P, and R, to find T, as in Caſe III. page 168

Q. How is T diſcovered?

A. Thus; $\frac{u}{p+u-pr} = r^t$ which being continually divided by *r*, till nothing remains, the number of thoſe diviſions will be $= t$

### EXAMPLES

1. The preſent worth of a certain leaſe in reverſion is 64l. 6s. 6d. 2 qrs. the leaſe is 20l. *per ann.* and commences 2

years hence, and the allowance to the purchaſer is 5 *per cent.* —I demand the time of its continuance? *An.* 4 *years.*

2. A certain man took a leaſe of ſome lands for a time, which by agreement was not to commence till the expiration of 4 years; the yearly rent was 32l. It was alſo agreed, that the purchaſer ſhould lay down 152l. 6s. 8d. 2 qrs and be allowed for his preſent pay 5 *per cent.*—I demand the time that the leaſe was taken for? *An.* 7 *years.*

3. The preſent payment for the leaſe of a houſe is 622l. 9s. 7.2d. and the yearly rent is 100l. Now, I have taken a leaſe in reverſion, which is to commence at the end of two years;—I demand the length of the leaſe, when I was allowed 4 *per cent.* for my money? *An.* 8 *years.*

### *Of purchaſing Real or Freehold Eſtates.*

Q. What do you underſtand by a Real or Freehold Eſtate?

A. Such as is bought to continue for ever.

Note, U repreſents the yearly rent; R the amount of 1l. &c. and P, the preſent worth.

### CASE I.

Q. When U, and R, are given to find P;—how is it diſcovered?

A. Thus; $\frac{u}{r-1}=p$.

### EXAMPLES.

1. Suppoſe a freehold eſtate of 40l *per ann.* is to be ſold; —what is it worth, allowing the buyer 5 *per cent* for his money? *An.* £800.

2. What is an eſtate of 290l. *per ann.* to continue for ever, worth in preſent money allowing 4 *per cent.* to the buyer? *An.* 7250l.

### CASE II.

Q. When P, and R, are given to find U;—how is it diſcovered?

A. Thus; $p\times\overline{r-1}=u$.

### EXAMPLES.

1. If a freehold eſtate is bought for 800l. and the allowance of 5 *per cent.* is made to the buyer;—I demand the yearly rent? *An.* £40 *per ann.*

2. If an eſtate be ſold for 7250l. preſent money, and 4 *per cent.* is allowed to the buyer for the ſame;—I demand the yearly rent? *An.* £290 *per ann.*

### CASE III.

Q. When P, and U, are given to find R; how is it diſcovered?

A. Thus; $\frac{p+u}{p}=r$.

### EXAMPLES.

1. If a real eſtate of 40l. *per ann.* be ſold for 800l—I demand the rate *per cent* ? *An.* £5 *per cent.*

2. If a freehold eſtate of 290l. *per ann* be bought for 7250l—I demand the rate *per cent.* allowed ? *An.* 4 *per cent.*

## *Of purchaſing Freehold Eſtates in Reverſion.*

### Caſe I.

Q. How many Operations are there in Caſe I. ?

A. Two.

Q. What is the firſt ?

A. Find the preſent worth of the yearly ſum at the given rate, to do which there are given U, and R, to find P.

Q. How is P diſcovered ?

A. Thus ; $\frac{u}{r-1}=p.$

Q. What is the ſecond operation ?

A. Find what principal being put to intereſt will amount to P, at the ſame rate, and for the time to come before the eſtate commences, and that will be the preſent worth of the eſtate in reverſion : Therefore let P be changed into A=the amount, and then there will be given A, R, and T, to find P=the principal.

Q. How is P diſcovered ?

A. Thus ; $\frac{a}{r^t}=p.$

### Examples.

1. Suppoſe a freehold eſtate of 40l. *per ann* to commence 3 years hence, is to be ſold, what is it worth, allowing the purchaſer 5 *per cent.* for his preſent payment ?

*An.* £691 : 1 : 4 : 3 *qrs*+

2. What is an eſtate of 290l. *per ann.* to continue for ever, but not to commence till the expiration of 4 years, worth in preſent money, allowance being made at 4 *per cent* ?

*An.* £6197 : 6 : 7 : 1 *qr*+

### Caſe II.

Q. How many operations are there in Caſe II ?

A. Two.

Q. What is the firſt ?

A. Find the amount of the preſent worth of the yearly rent, at the given rate, and for the time before the eſtate commences ;—to do which there are given P, T, and R, to find A.

Q. How is A diſcovered?

A. Thus; $pr^t = a$.

Q. What is the ſecond operation?

A. Find what yearly rent being ſold will produce A for the preſent worth, at the ſame rate, and that will be the yearly ſum required: Therefore let A be changed into P, and then there will be given P, and R, to find U, or the yearly ſum.

Q. How is U diſcovered?

A. Thus; $\frac{\overline{pr} \times r - pr}{r} = u$.

Examples.

1. Suppoſe a freehold eſtate, to commence 3 years hence, is ſold for 691l. 1s. 5d. allowing to the purchaſer 5 *per cent*—I demand the yearly income? *An.* 40*l. per ann.*

2. There is a certain freehold eſtate bought for 6197l. 6s. 7d. 1 qr. which does not commence till the expiration of 4 years; the buyer was allowed 4 *per cent.* for his money;—I demand the yearly income? *An.* £290 *per ann.*

*Of Rebate or Diſcount.*

Q. What particular letters are uſed here?

A. Theſe:

S, the ſum to be diſcounted for,
P, the preſent worth of that ſum, due at any time to come,
T, the time before it becomes due; and
R, the amount of 1l. for 1 year, at any rate *per cent.*

Caſe I.

Q. When S, T, and R, are given to find P;—how is it diſcovered?

A. Thus: $\frac{s}{r^t} = p$

Examples.

1. What is the preſent worth of 520l. 18s. 7d. 2 qrs. payable 3 years hence, at 5 *per cent*? *An.* £450.

2. There is a debt of 504l. 19s. 9d. 3 qrs. which is not due until 4 years hence; but it is agreed to be paid in preſent money;—what ſum muſt the creditor receive, allowing the rebate of 6 *per cent.* to the debtor for his money? *An.* £400.

3. If 643l. 4s 11d. be payable in 6 years time, what is the preſent worth, rebate being made at 5 *per cent*?

*An.* £480.

## CASE II.

Q. When P, T and R, are given to find S;—how is it diſcovered?

A. Thus; $p \times r^t = s$.

### Examples.

1. If 450l. be received for a debt, payable 3 years hence, and an allowance of 5 *per cent.* was made to the debtor for his preſent payment;—I demand what the debt was?

*An.* £520 : 18 : 7 : 2 *qrs.*

2. There is a ſum of money, due at the expiration of 4 years, but the creditor agrees to take 400l. down, allowing 6 *per cent.* on preſent payment;—I demand what the debt was?

*An.* £504 : 19 : 9 : 3 *qrs.*

3. If a ſum of money, due 6 years hence, produces 480l. for preſent payment, rebate being made at 5 *per cent*—I demand how much the debt was? *An.* £643 : 4 : 11*d.*

## Case III.

Q. When S, P, and R, are given to find T;—how is it diſcovered;

A. Thus; $\frac{s}{p} = r^t$.

which being continually divided by *r*, till nothing remains, the number of thoſe diviſions will be=*t*.

### Examples.

1. A certain man received 450l. down, for a debt of 520l. 18s. 7d. 2 qrs. rebate being made at 5 *per cent* – I demand in what time the debt was payable? *An.* 3 *years.*

2. There is a debt of 504l. 19s. 9d. 3 qrs. payable at a certain time, but it is agreed to pay 400l. down, at the allowance of 6 *per cent.* to the debtor for his preſent money:—I demand in what time the debt will become due, if no ſuch payment was to be made? *An.* 4 *years.*

3. The preſent payment of 480l. is made for a debt of 643l. 4s. 1d. rebate at 5 *per cent*—I demand when the debt was payable? *An.* 6 *years.*

## Case IV.

Q. When S, P, and T, are given to find R;—how is it diſcovered?

A. Thus; $\frac{s}{p}=r^{t}$ { which muſt be extracted by the rules of extraction; the time given in the queſtion $=t$, ſhewing the power.

EXAMPLES.

1. The preſent worth of 520l. 18s. 7d 2 qrs. payable 3 years hence is 450l—I demand at what rate *per cent.* rebate is made? *An* 5 *per cent.*

2. A debt of 504l 19s. 9d. 3 qrs. will be due 4 years hence, but it is agreed to take 400l. down;—what is the rate *per cent.* that the rebate is made at? *An.* 6 *per cent.*

3. The ſum of 643l. 4s. 11d. is payable in 6 years time; and the preſent worth of that ſum is 480l—I demand at what rate *per cent.* muſt rebate be made, to produce the ſaid preſent worth? *An* 5 *per cent.*

*Note*, 1. Equation of payments, at compound intereſt, ſhould follow next, but as that rule is beſt done by the Logarithms, the kind reader will, I hope, take this as a ſufficient reaſon for not placing it here.

2. The whole buſineſs of Compound Intereſt is better performed by the Logarithms, or by tables calculated for that purpoſe, than otherwiſe; eſpecially when the time given is very long, as for 20, 30, or 40 years, and when the payments are to be made half-yearly or quarterly. What is here done ſerves only for whole years, and ſhews what can be done by the pen, where the Logarithms or tables are wanting.

## A practical and eaſy Method to caſt up the VALUE of TIMBER.

RULE. Multiply the number of feet by the price (in ſhillings) *per* load, and cut off 3 places to the right hand, which makes pound and decimal parts thereof.

EXAMPLES.

754 feet at 1l. 7s 6d. *per* load.

754 754 at 6d=377.

27

20358

+377

£ *s.* *d.*

20.735=20 14 9¼

856 feet at 1l. 6s. *per* load.

*Facit* £22 : 5 : 1½*d.*

730 feet at £1 : 8 : 6*d. per load.*

*Facit* £20 : 16 : 1*d.*

433 feet at £1 : 3 : 6*d. per load.*

*Facit* £10 : 3 : 6*d.*

DEMONSTRATION. 50 Feet make a load; therefore it is, As 50 feet : price in ſhillings : : Feet given : Value in ſhillings, which ÷ 20 are pounds: But as 50 × 20 = 1000, which is a diviſor for pounds; therefore the firſt figure being 1, and the reſt cyphers, diviſion is made at once by pointing off three places above.

# THE
# SCHOOLMASTER'S ASSISTANT.

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## PART IV.

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## A Collection of Queſtions to exerciſe the foregoing Rules.

1. WRITE down nine hundred millions, ſeven hundred ſixty thouſand and twenty-one.

2. What muſt 20s. pay towards a tax, when 326l. 6s. 8d. is aſſeſſed at 41l. 16s. 2d? *An* 2*s*. 6*d*. 2 *qrs*. $\frac{77601}{78320}$.

3. If the $\frac{1}{3}$ of 6 be 2, what will the $\frac{1}{4}$ of 30 be? *An*. $7\frac{1}{2}$.

4. I demand the ſum of 1738 added to itſelf? *An*. 3476.

5. I demand the product of 76 multiplied by itſelf? *An*. 5776.

6. I demand the difference between 14676 and the fourth of itſelf? *An*. 11007.

7. I demand the quotient of the ſquare of 476 divided by the half of its root? *An*. 952.

8. There is, in 3 bags, the ſum of 1468l. *viz*. in the firſt bag 461l in the ſecond 581l. I demand what is in the third bag? *An*. £426.

9. What number is that which being multiplied by 13, the product will be 221? *An*. 17.

10. Two perſons, A and B, owe ſeveral debts; the leſſer debt, being that of A, is 2173l. the difference is 371l. what is the debt of B? *An*. £2544.

11. A captain and 160 ſailors took a prize, worth 1360l. of which the captain had $\frac{1}{5}$ for his ſhare, and the reſt was equally divided among the ſailors; what was each man's part?

*An* *The captain had* 272*l*. *and each ſailor had* 6*l*. 16*s*.

12. An ancient lady being demanded how old ſhe was; to avoid a direct anſwer, ſaid, I have 9 children, and there are 3 years between the birth of each of them; the eldeſt was born when I was 19 years old, which is now exactly the age of the youngeſt: how old was the lady? *An*. 62 *years old*.

13. What number is that from which if you take 341, the remainder will be 726? *An*. 1067.

14. What number is that which being added to 168, make the ſum to be 706? *An.* 538.

15. What number is that which being divided by 19, the quotient will be 72? *An.* 1368.

16. A broker bought for his principal, in the year 1720, 400l. capital ſtock in the South Sea, at 650l. *per cent.* and ſold it again when it was worth but 130 *per cent.* how much was loſt in the whole? *An.* £2080.

17. The ſum of two numbers is 4139, their difference is 948; what is the leſſer number? *An.* 1595.5

18. A gentleman went to ſea at 17 years of age; 8 years after that he had a ſon born, who lived 46 years, and died before his father; after whom the father lived twice 20 years, and then died alſo: I demand the age of the father when he died? *An.* 111 *years.*

19. Three Gardeners, A, B, and C, having bought a piece of ground, find the profits of it amount to 120l. *per annum.* Now the ſum of money which they laid down was in ſuch proportion, that as often as A paid 5l. B paid 7l. and as often as B paid 4l. C paid 6l. I demand how much each man muſt have *per annum* of the gain?

| | *B* | | *A* | | *B* | | *A* |
|---|---|---|---|---|---|---|---|
| As | 7 | : | 5 | : : | 4 | : | $2\frac{6}{7}$ |
| | *A* | | *C* | | *A* | | *C* |
| | $2\frac{6}{7}$ | : | 6 | : : | 5 | : | $10\frac{1}{2}$ |

| | | *l.* | *s.* | *d.* |
|---|---|---|---|---|
| *An.* | *A* | 26 | 13 | 4 |
| | *B* | 37 | 6 | 8 |
| | *C* | 56 | 0 | 0 |
| | | 120 | 0 | 0 |

20. A, B, and C, freight a ſhip with wine, *viz.* A lays out 1342l; B 1178l; C 630l. the whole 212 tuns, are ſold at 32l. *per* tun; what ſhall each man receive?

| | | *l.* | *s.* | *d.* | *qrs.* |
|---|---|---|---|---|---|
| *An.* | *A* | 2890 | 3 | 11 | $3\frac{1230}{3150}$ |
| | *B* | 2537 | $\frac{2}{3150}$ | | |
| | *C* | 1356 | 16 | 0 | |

21. A, B, and C, made up a ſtock of 1000l. whereof A put in 409l. B, 198l. and they improved it to 1964l. I demand what was the ſtock of C, and what was each man's ſhare of the whole gain?

| | | *l.* | *s.* | *d.* |
|---|---|---|---|---|
| *An.* | *C's ſtock was* | 393 | 0 | 0 |
| | *A's share was* | 803 | 5 | $6\frac{240}{1000}$ |
| | *B's* - - | 388 | 17 | $5\frac{280}{1000}$ |
| | *C* - - - | 771 | 17 | $0\frac{480}{1000}$ |

22. A, B, and C, freight a ſhip for the Canaries worth 3696l. whereof A put in 369l B 897l. but by reaſon of a ſtorm, one third of the goods were caſt overboard;—I demand each man's ſhare of the loſs?

*An. A's loſs was 123l.; B's 299l.; and C's 810l.*

23. A and B traded together and gained 100l A put in 640l. B put in ſo much that he muſt receive 60l. of the gain;—I demand how much B put in? *An.* £960.

24. What is the value of 27 doz. 10lb. of candles, at 5d. *per* lb? *An.* £6 : 19 : 2.

25. Bought 28 qrs. 2 buſhels of wheat, at 4s. 6d. *per* buſhel; what is the worth of it? *An.* £50 : 17*s*.

26. If a man earns 2s. 6d. 2 qrs. per day, how much is that for 19 weeks, Sundays excepted? *An.* £14 : 9 : 9.

27. A, B, and C, traded together; the firſt laid in I know not how much; B put in 20 pieces of cloth; and C put in 500l. and they have gained 1000l. whereof A ought to have 350l. and B 400l.—I demand C's ſhare, how much the firſt man laid in, and what the 20 pieces of cloth were worth?

*An C's ſhare was 250l; A laid in 700l; and B's Cloth was worth 800l.*

28. A merchant buys up ſix bags of Canterbury hops, No 1. of which weighed 3 cwt. 3 qrs. 20 lb. No 2. 3 cwt. 2 qrs. 26 lb. No 3. 3 cwt 24lb. No 4. 3 cwt. 3 qrs. only, No 5. 2 cwt. 2 qrs. 22lb. No 6. 2 cwt. 2 qrs. 26lb; beſides 5 pockets, 3 of which weighed 76$\frac{3}{4}$ lb. each; and the other two 62$\frac{1}{4}$ lb. each; how many cwt has he to pay carriage for? *An. 23 cwt. 0 qrs. 24$\frac{3}{4}$lb.*

29. How many ducats muſt I deliver at Venice to receive at London 178l. 2s. the Exchange being at 4s. 4d. *per* Ducat? *An.* 822 *ducats.*

30. A traveller would change 500 French Crowns at 4s. 6d. *per* crown into ſterling money, but he muſt pay a halfpenny *per* crown for change; how much muſt he receive?

*An.* £111 : 9 : 2.

31. When a factor taketh 1l. *per cent.* for his commiſſion, what muſt he have for 743l. 17s. 3d.?

*An.* £7 : 8 : 9 : 1 *qr.* $\frac{192}{2400}$.

32. Two merchants in company gained 100l. A laid in ſo much, that for his ſhare of the gain he muſt have 60l. B laid in 720 ducats at 6s. 8d. *per* ducat; I demand how much A laid in, and what the ducats were worth?

*An. A laid in 360l. and the ducats were worth 240l.*

33. There were two merchants who traded in company; the firſt laid in the ſum of 640l. and took $\frac{5}{8}$ of the gain; I demand how much the ſecond merchant laid in? *An.* £384.

34. What number is that, which being multiplied by 15, the product will be $\frac{3}{4}$? *An.* $\frac{1}{20}$.

35. I demand the $\frac{5}{8}$ of 20s.? *An.* 12*s.* 6*d.*

36. What fraction is that, to which if you add $\frac{2}{5}$ the ſum will be $\frac{5}{6}$? *An.* $\frac{13}{30}$.

37. What number is that, to which if you add $7\frac{2}{5}$ the whole will be $12\frac{1}{4}$? *An.* $4\frac{17}{20}$.

38. What number is that, from which if you take $\frac{3}{5}$ the remainder will be $\frac{1}{8}$? *An.* $\frac{29}{40}$.

39. What number is that, from which if you take $13\frac{1}{2}$ the remainder will be $5\frac{5}{7}$? *An.* $19\frac{3}{14}$.

40. What number is that, which being divided by $\frac{3}{4}$ the quotient will be 21? *An.* $15\frac{3}{4}$.

41. What number is that, which being multiplied by $\frac{2}{3}$ produceth $\frac{1}{4}$? *An.* $\frac{3}{8}$.

42. What number is that, from which if you take $\frac{2}{5}$ of itſelf, the remainder will be 12? *An.* 20.

43. What part of 25 is $\frac{5}{8}$ of an unit? *An.* $\frac{1}{40}$.

44. What number is that, to which if you add its own $\frac{2}{3}$ the whole ſhall be 20? *An.* 12.

45. What number is that which maketh 9 to be the $\frac{2}{3}$ of it? *An.* $13\frac{1}{2}$.

46. If a cannon may be diſcharged at twice with 6lb. of powder; how many times will 7 cwt. 3 qrs. 17lb. diſcharge the ſame piece? *An.* 295 *times.*

47. If $\frac{3}{8}$ of a ſhip be worth 3740l. what is the whole worth? *An.* £9973 : 6 : 8*d.*

48. A young man received 210l. which was $\frac{2}{3}$ of his elder brother's portion: Now three times the elder brother's portion was half of the father's eſtate; I demand how much the eſtate was? *An.* £1890.

49. A factor bought a certain quantity of broad cloth and drugget, which together coſt him 81l. The quantity of broad cloth that he bought was 50 yards, at 18s. *per* yard, and for every five yards of broad cloth he had 9 yards of drugget; I demand how many yards of drugget he had, and how much the drugget coſt him *per* yard?

*An.* 90 *yards of drugget, at* 8*s. per yard.*

50. A certain uſurer lent out 90l. for 12 months and received principal and intereſt 95l. 8s.—I demand at what rate *per cent* he received intereſt? *An. £* 6 *per cent.*

51. Two men depart both from one place, the one goes north and the other ſouth, the one goes 7 miles a day, and the other 11 miles a day; how far are they diſtant the 12th day after their departure? *An.* 216 *miles.*

52. A merchant bought 8 tuns of wine, which having received damage, he ſold for 400l. and 12l. *per cent.* loſs; I demand how much it coſt him *per* tun, and how he ſold it *per* gallon, to loſe after the ſaid rate?

*An.* { *Coſt* £56 : 16 : 4 : 1 *qr.* $\frac{5}{11}$ *per tun.*
{ *Sold at* 0 : 3 : 11 : 2 *qrs.* $\frac{900}{1008}$ *per gallon.*

53. Two men depart both from one place, and both go the ſame road; the one travels 12 miles every day, the other 17 miles every day;—how far are they diſtant the 10th day after their departure? *An* 50 *miles.*

54. If a gentleman hath an eſtate of 1000l. *per ann.*—how much may he ſpend one day with another, to lay up threeſcore guineas at the year's end? *An £* 2 : 11 : 4*d* $\frac{40}{365}$.

55. If 76lb. of cinnamon coſt 40l. 10s. 8d. and 1 cwt of nutmegs 59l 14s. 8d.—I demand the price of 3 oz. one with another? *An.* 2*s.*

56. A grocer delivered 17 cwt. 3 qrs. 10lb. of tobacco in the roll, to be cut and dried, and when it came home, it held out 16 cwt. 14lb —I demand how much was loſt in every lb. and alſo, ſuppoſing it coſt in the roll 8$\frac{6}{7}$d. *per* lb. and the cutting, 1$\frac{5}{8}$d. *per* lb. I demand what it now ſtands him in?

*An.* { *Loſt per lb.* 1 *oz.* 8 *dr.* $\frac{1200}{1998}$.
{ *It ſtands him in* £87 : 5 : 3 : 1 *qr.* $\frac{16}{56}$.

57. If tallow be ſold for 4d. *per* lb.—what is the value of 3 tubs, each 3 cwt. 1 qr. 10lb. groſs, tare *per* tub 25lb?

*An £* 17 : 9*s.*

58. Shipped from Spain 10 tuns of wine at 10l. ſterling *per* hhd. paid cuſtom at the port of London 1s. *per* gallon: the charges for lighterage, cartage, and porterage, amounted to 5l. afterwards by the misfortune of a pipe ſtaving, containing 126 gallons, I loſt 59 gallons; the next day 28 gallons more run out, and the remainder of the pipe not being ſaleable, I threw it away: The market price not running high, I ſold the reſt for 17l. *per* hhd.—I demand how much I gained or loſt by the ſale of the ſaid wine? *An. Gained £* 115.

59. A ſhip's company took a prize of 300l. which is to be divided among them as parties, according only to their pay, and the time they have been on board; the officers and midſhipmen 5 months, and the ſailors 3 months. The officers, one with another, had 40s. *per* month; the midſhipmen 30s. *per* month, and the ſailors 22s. There were 6 officers, 12 midſhipmen, and 84 ſailors;—what muſt each party have of the prize, and what each ſingle perſon?

| | | *l.* | *s.* | *d.* | *qr.* | | *l.* | *s.* | *d.* | *qr.* |
|---|---|---|---|---|---|---|---|---|---|---|
| *An.* | *The Officers* | 144 | 4 | 7 | $1\frac{224}{416}$ | *each man.* | 24 | 0 | 9 | 0+ |
| | *Midſhipmen* | 108 | 3 | 5 | $2\frac{64}{416}$ | | 9 | 0 | 3 | 1+ |
| | *Sailors* - - | 57 | 11 | 11 | $0\frac{128}{416}$ | | 0 | 11 | 3 | 3+ |

60. If 1000lb. of beef ſerve 240 men 8 days,—how many lb. will ſerve 460 men 10 weeks?

*An.* £16770*lb.* 13 *oz.* $\frac{640}{2929}$.

61. What is the amount of 1000l. for 5 years and an half at $4\frac{3}{4}$ *per cent.* ſimple intereſt? *An.* £1261 : 5*s.*

62. Sold goods amounting to the value of 700l. for two 4 months;—What is the preſent worth, at 5 *per cent.* ſimple intereſt? *An.* £682 : 19 : 5*d.* 2 *qrs.*

63. A merchant bought 400 cloths, at 12l. *per* cloth, which he ſhipped for Spain, to have returns from thence, the one half in wine at 30l. *per* tun, and the other half in rice, at 28s. *per* cwt.—I demand how much of each muſt be returned for the cloth?

*An.* 80 *tuns of wine, and* 1714 *cwt.* 1 *qr.* 4*lb. of rice.*

64. A tobacconiſt hath ſeveral ſorts of tobacco, viz. of 12d. *per* lb. of 16d. *per* lb. of 18d. *per* lb. and of 2s. *per* lb. and he is deſirous to make a mixture of an cwt. worth 20d. *per* lb.—I demand how much of each ſort muſt be taken.

| | *lb.* | *oz.* | *d. per lb.* |
|---|---|---|---|
| *An.* | 17 | $3\frac{18}{26}$ | *at* 12 |
| | 17 | $3\frac{18}{26}$ | *at* 16 |
| | 17 | $3\frac{18}{26}$ | *at* 18 |
| | 60 | $4\frac{24}{26}$ | *at* 24 |

65. A brewer mixed 17 gallons of ale at 8d *per* gallon, with 19 gallons at 10d. *per* gallon, and with 40 gallons at 6d. *per* gallon,—I demand what one gallon of this mixture is worth, and alſo the worth of the whole quantity?

*An.* £0 : 0 : 7 : 1 *qr.* $\frac{60}{76}$ *per gallon.*
2 : 7 : 2 : 0 *the pipe of the whole mixture.*

66. There are two numbers, the one 48, the other twice as much;—I demand the difference between their ſum and difference? *An.* 96.

67. There are two numbers, the one 63, the other half as much;—I demand the product of their ſquares and the difference of their product and ſum.

*An.* { *Product of the ſquares* 3938240 25
*Difference* - - - - - - - - - - - - 1890

68. There are two numbers, the one 25, the other the ſquare of 25; I demand the ſquare root of the ſum of their ſquares? *An.* 625.4998+

69. There are two numbers, whoſe product is 1058, and multiplicand 46; I demand the multiplier, the ſum of their factors, and the difference between the ſum of the cubes of the factors, and the ſquares of the product?

*An.* { *Multiplier* - - - - - - - - 23.
*Sum of the factors* - - - 69.
*Difference* - - - - 1009861.

70. There are two numbers, whoſe dividend is 1216, and the quotient 76; I demand the diviſor, the difference between the cube of the quotient, and the ſum of the ſquares of the diviſor and dividend, and the cube-root of the ſum of the cubes of the diviſor, dividend and quotient?

*An.* { *Diviſor* - - - - - - - - - - 16.
*Difference* - - - 1039936.
*Cube-Root* - - - - - - 1216.

71. Two men ſet out at the ſame time from the ſame place but go contrary ways; and they travel each of them 34 miles a-day; I demand the time in which they will have travelled 2000 miles? *An.* 29 *days*, 9 *hours*, 52 *min.* $\frac{64}{68}$.

72. Six rogues, *viz.* A, B, C, D, E, and F, having entered into a confederacy, do agree to divide whatever ſums of money they ſhall at any time take upon the highways, according to their valour, that is in proportion to the number of ſcars they ſhould then have on their faces: Now the firſt two, *viz* A, and B, being very bold and daring fellows, had received A 20, and B 19 ſcars; the next two *viz.* C, and D, having a leſs ſhare of courage, and not caring to ſtand all brunts, had each of them but 9 ſcars; but the other two, *viz.* E, and F, being mere cowards, always turned their backs at the leaſt oppoſition, and ſo by chance they had one a-piece, and they having, at ſeveral times ſtolen the ſum of 700l. 13s—I deſire to know how they muſt divide it?

| | | *l.* | *s.* | *d.* | *qrs.* |
|---|---|---|---|---|---|
| *An.* | *A muſt have* | 237 | 10 | 2 | 0$\frac{8}{59}$. |
| | *B* - | 225 | 12 | 7 | 3$\frac{43}{59}$. |
| | *C* - | 106 | 17 | 6 | 3$\frac{39}{59}$. |
| | *D* - | 106 | 17 | 6 | 3$\frac{39}{59}$. |
| | *E* - | 11 | 17 | 6 | 0$\frac{24}{59}$. |
| | *F* - | 11 | 17 | 6 | 0$\frac{24}{59}$. |

73. There are three numbers, 17, 19, and 48; I demand the difference between the ſum of the ſquares of the firſt and laſt, and the cube of the middlemoſt? *An.* 4266.

74. In 7 cheeſes, each weighing 1 cwt. 2 qrs. 5lb how many allowances for ſeamen may be cut, each weighing 5 oz. 7 dr? *An.* 3563$\frac{35}{87}$ *allowances.*

75. In 81034 Rundlets of brandy, each 18 gallons, how many groſs of bottles each $\frac{8}{9}$ of a quart?
*An.* 45581 *groſs,* 7 *dozen,* 6 *bottles.*

76. In 731 dozen bottles of wine, each 1$\frac{5}{7}$ pint, how many hhd? *An.* 29 *hhd.* 2 *gal.* 5 *pts.*

77. Sold 8$\frac{1}{2}$ cwt. of ſteel, at 12d. *per* lb. how much Flemiſh money, at 33s 8d. *per* pound ſterling, am I to receive for the ſame? *An.* £80 : 2 : 6*d.* $\frac{00}{340}$ *Flemiſh.*

78. If 48 taken from 120 leave 72, and 72 taken from 91 leave 19, and 7 taken from thence leave 12; what number is that, out of which when you have taken 48, 72, 19 and 7, leaves 12? *An* 158.

79. A hath $\frac{1}{2}$ of a ſhip, B $\frac{1}{4}$, C $\frac{1}{16}$, D $\frac{3}{16}$; the maſter clears 120l. how much muſt each owner have?

| | | *l.* | *s.* |
|---|---|---|---|
| *An.* | *A muſt have* | 60 | 0 |
| | *B* - - | 30 | 0 |
| | *C* - - | 7 | 10 |
| | *D* - - | 22 | 10 |

80. A gentleman having 50s. to pay among his labourers for a day's work, would give to every boy 6d. to every woman 8d. and to every man 16d. the number of the boys, women and men, was the ſame; I demand the number of each? *An.* 20 *of each ſort.*

81. A gentleman had 7l. 17s. 6d. to pay among his labourers; to every boy he gave 6d. to every woman 8d. and to every man 16d. and there were for every boy three women, and for every woman two men: I demand the number of each? *An.* 15 *boys,* 45 *women,* 90 *men.*

82. Admit a tax of 39l. is laid on a town for the building of a bridge, and the value of the town rent is 900l. *per ann.* —what ſhall a man pay towards it, whoſe income is worth 100l. *per ann.*? *An.* £4 : 6 : 8.

83. Suppoſe A hath an eſtate of 53l. *per ann.* and pays 5s. 10d. to a ſubſidy; what ſhall B pay, whoſe eſtate is worth 100l. *per ann.*? *An.* 11*s.* 0*d.*$\frac{4}{53}$.

84. If 136l. are to be divided between 2 men, ſo as the leſſer ſhare may have ſuch proportion to the greater as 2 to 5,—what muſt each man have?

| *An.* | *l.* | *s.* | *d.* | *qrs.* |
|---|---|---|---|---|
| *One muſt have* | 38 | 17 | 1 | 2$\frac{6}{7}$ |
| *The other* - - | 97 | 2 | 10 | 1$\frac{1}{7}$ |

85. There are 1000l. to be divided among 3 men, in ſuch manner that if A have 3l. B ſhall have 5l. and C 8l. how much muſt each man have?

| *An.* | *l.* | *s.* |
|---|---|---|
| *A muſt have* | 187 | 10 |
| *B* - - | 312 | 10 |
| *C* - - | 500 | 0 |

86. Shipped for Jamaica 550 pair of ſtockings at 11s. 6d. *per* pair, and 460 yards of ſtuff, at 14d. *per* yard; in return for which I had 46 cwt. 3 qrs. of ſugar, at 24s. 6d. *per* cwt. and 1570 lb. of Indigo, at 2s. 4d. *per* lb.—what remains due to me of my adventure? *An.* £102 : 12 : 11 : 2 *qrs.*

87. If one pound ten, and forty groats
Will buy a load of hay;
How many pounds with nineteen crowns
For twenty loads will pay? *An.* £38 : 11 : 8.

88. A man driving his geeſe to the market, was met by another, who ſaid good-morrow maſter with your hundred geeſe. Says he, I have not an hundred: but if I had half as many as I now have, and two geeſe and an half, beſide the number I have already, I ſhould have an hundred: How many had he? *An.* 65.

89. If a tower be 384 feet high from the foundation, and a ſixth part be under the earth, and an eighth part under the water;—how much in height is viſible? *An.* 272 *feet.*

90. A merchant would lay out in ſpices 560l. at the following prices, viz. cloves at 4s. *per* lb. mace, at 7s. cinnamon at 3s. nutmegs at 12s. and pepper at 2s. *per* lb. and he would have an equal quantity of each ſort;—I demand that quantity? *An.* 400*lb. of each ſort.*

91. The computed diſtance between London and York is 150 miles; now if a man ſets out from London and walks every day towards York 20 miles and back again towards London 15 miles;—how long will it be before he gets to his journey's end? *An.* 27 *days.*

92. Bought 127 pieces of cloth, for which I delivered 3589 ells of holland, at 7s. 11d. *per* ell Engliſh,—what coſt a piece of that cloth? *An* £11 : 3 : 8 : 2 *qrs.* $\frac{94}{127}$.

93. The account of a certain ſchool is as followeth, viz. $\frac{1}{16}$ of the boys learn geometry, $\frac{3}{8}$ learn grammar, $\frac{3}{10}$ learn arithmetic, $\frac{3}{20}$ learn to write, and 9 learn to read;—I demand the number of each? *An.* 5 *geometers*, 30 *grammarians*, 24 *arithmeticians*, 12 *writers, and* 9 *readers.*

94 I have laid out for a merchant 638l. 17s. 3d. he allows me 2¾ *per cent.* before that I owed him 184l. 17s. 9d. how much is he indebted to me? *An.* £471 : 10 : 10 : 1 *qr.*

95. Bought a tun of wine for 78l 17s. at what price muſt I ſell it *per* quart to gain 5l. 10. by the whole, when there were 22 gallons leaked out? *An* 12*d.*+

96. If out of 10s. *per* week, I lay up 4d. 2 qrs *per* day. Sundays excepted, and have ſaved 9l. 2s. 3d. how long was I in laying up, and how much have I ſpent in that time?

*An.* { 576 *days in laying up.*
£31 : 7 : 9 *ſpent.*

97. If I buy 100 ells Flemiſh of linen for 90l.—what may I ſell it at *per* ell in London, to gain 10l by the whole. *An* 3s. 4d. *per ell.*

98. Bought threeſcore pieces of Holland for 3 times as many pounds, and ſold them again for 4 times as much: but if they had coſt me as much as I ſold them for,—what ſhould I have ſold them for, to gain after the ſame rate? *An.* £320.

99. There are three quantities of ſilver, each of the ſame weight, but different in value; the weight of each quantity is 10 oz. the value of the firſt ſort is 4s. *per* oz. of the ſecond 4s. 6d. *per* oz. and of the third 5s. *per* oz.—I demand the worth of an oz when they are all melted together? *An.* 4*s.* 6*d. per oz.*

100. I have received advice from my factor, that he has diſburſed upon my account the ſum of 4000 guilders, 15 ſtivers;—I demand what ſum I muſt anſwer for that in Engliſh money, exchange at par; and alſo what his commiſſion comes to at 2 *per cent.*

*An.* { £400 : 1 : 6¼*d. ſterling.*
8 : 0 : 0 : 1 *qr. commiſſion.*

101. A merchant bought a parcel of jewels for 220l. and ſold them again for 440l payable at the end of 6 months;—I demand what the gain was worth in ready money; Rebate being made at 6 *per cent.*? *An.* £213 : 11 : 10+

102. A factor bought 4 cheſts of ſugar, the mark and weight as follows;

|  | *C* | *qrs.* | *lb.* |
|---|---|---|---|
| *A* - - - | 10 | 3 | 14 |
| *B* - - - | 12 | 1 | 17 |
| *C* - - - | 13 | 1 | 19 |
| *D* - - - | 11 | 2 | 10 |

Now ſuppoſe the tare or weight of every cheſt, when it is empty, to be 38lb.—I demand the neat weight of the ſaid ſugar; alſo I demand the prime coſt of the ſame, ſuppoſing it came to 18s. *per* cwt. including the charges of lighterage, porterage, warehouſe-room, cuſtom, &c. alſo I demand the whole gain, and the gain *per cent.* ſuppoſing the cheſts A and B were ſold afterwards at 28s. *per* cwt. and the other two cheſts, viz. C and D, at 4d. *per* lb.?

| | | | | | |
|---|---|---|---|---|---|
| *Anſ.* | *Prime Coſt* - | £42 | : | 4 | : $8\frac{1}{2}$*d.* |
| | *Whole gain* - | 34 | : | 16 | : $4\frac{1}{2}$ |
| | *Gain per cent.* - | 82 | : | 8 | : $9\frac{1}{2}$ |

103. A gentleman a chaiſe did buy,
A horſe and harneſs too;
They coſt the ſum of threeſcore pounds,
Upon my word 'tis true;
The harneſs came to half of th' horſe,
The horſe twice of the chaiſe,
And if you find the price of them,
Take them and go your ways.

| | | |
|---|---|---|
| *An.* | *Chaiſe* - | £15 |
| | *Horſe* - | 30 |
| | *Harneſs* - | 15 |

104. A gentleman courted a young lady, and as their birthdays happened together, they agreed to make that their wedding-day. On the day of marriage it happened that the gentleman's age was juſt double to that of the lady's, that is as 2 to one. After they had lived together 30 years, the gentleman obſerved that his lady's age drew nearer to his, and that his was only in ſuch proportion to her's as 2 to $1\frac{3}{7}$. Thirty years after this the ſame gentleman found his and his lady's ages to be as near as 2 to $1\frac{3}{5}$; at which time they both died. I demand their ſeveral ages, at the day of their marriage and of their death; alſo the reaſon why the lady's age, which was continually gaining upon her huſband's, ſhould, notwithſtanding be never able to overtake it?

## *A ſhort Collection of Pleaſant and Diverting* QUESTIONS.

1. A General having a caſtle, ſituated on a ſquare, and garriſoned by 48 ſoldiers. ſo ordered them as that any two corners and the ſide between them ſhould conſiſt of 18 men; but he thinking there were not men enough, hired 8 more, but ſtill kept up the ſame number of 18 men as before; afterwards 16 men were paid off, he not having occaſion for them; but yet he kept up his number of 18 men; I demand how he muſt place the ſaid men, to make 18 every way, when he had 48, 56, and 40 ſoldiers.

2. A poor woman carrying ſome eggs to market, met with a rude fellow, who broke them all; but preſently after conſidering what he had done, went back and told the woman he was willing to make ſatisfaction, provided ſhe could tell how many there were; ſhe anſwered ſhe could not tell, but the beſt account that ſhe could give, was, that when ſhe told them in by two at a time, there was one left, when by three, there was one left, and when by four, there was one left, but when ſhe told them in by five, there was none left:—I demand how many eggs the woman had?

3. A gentleman's ſervant went to the market with an order to buy 20 fowls for 20d. he did ſo; and brought home pigeons at 4d. a-piece, larks at a half-penny a-piece, and ſparrows at a farthing a-piece:—I demand how many there were of each ſort?

4. Suppoſe the 9 digits to be placed in a quadrangular form:—I demand in what order they muſt ſtand, that any three figures in a right line may make juſt 15.

5. Let 12 be ſet down in 4 figures, and let each figure be the ſame.

6. A countryman having a fox, a gooſe, and a peck of corn, in his journey came to a river, where it ſo happened that he could carry but one over at a time. Now, as no two were to be left together that might deſtroy each other, he was at his wits end how to diſpoſe of them. For, ſays he, Though the corn cannot eat the gooſe, nor the gooſe eat the fox, yet the fox can eat the gooſe, and the gooſe eat the corn. The queſtion is,—how he muſt carry them over, that they might not devour each other?

7. Three jealous huſbands with their wives, being ready to paſs by night over a river, do find at the waterſide a boat which can carry but two perſons at once, and, for want of a waterman, they are neceſſitated to row themſelves over the river at ſeveral times: The queſtion is,—how theſe 6 perſons ſhall paſs by 2 and 2, ſo that none of the three wives may be found in the company of 1 or 2 men, unleſs her huſband be preſent?

8. Two merry companions are to have equal ſhares of 8 gallons of wine, which are in a veſſel containing exactly 8 gallons: Now to divide it equally between them, they have only two other empty veſſels, of which one contains 5 gallons and the other 3. The queſtion is,—how they ſhall divide the ſaid wine between them by the help of theſe 3 veſſels, ſo that they may have gained 4 gallons a-piece? *Wingate.*

9. Says Jack to his brother Harry I can place four threes in ſuch manner that they ſhall make juſt 34;—can you do ſo?

THE

# SCHOOLMASTER'S ASSISTANT.

## PART V.

## OF DUODECIMALS.

Q. WHAT are Duodecimals?

A. They are fractions of a foot, or of an inch, or any part of an inch, having 12 for their denominators.

### *Notation of Duodecimals.*

Q. HOW do you write Duodecimals?

| | F. | I. | '' | ''' | '''' | |
|---|---|---|---|---|---|---|
| A. Thus; | 3 | 7 | 2 | 3 | 7. | &c. |

Q. How do you read them?

A. Thus; 3 feet, 7 inches, 2 ſeconds, 3 thirds, 7 fourths, &c.

*Note*, 1. Some call the inches primes, and mark them thus, 7I.

2. Though this manner of dividing and ſubdividing a foot is endleſs, yet, it is only ſo in imagination, and cannot be reduced to practice, becauſe a ſecond, or the twelfth part of an inch is ſo ſmall, as to be incapable of any further diviſion.

### *Addition of Duodecimals.*

*Note*, 12 Fourths make 1 Third.
12 Thirds —— 1 Second.
12 Seconds —— 1 Inch.
12 Inches —— 1 Foot.

EXAMPLES.

| F. | I. | '' | ''' | '''' |
|---|---|---|---|---|
| 14 | 4 | 3 | 5 | 6 |
| 17 | 10 | 11 | 10 | 4 |
| 16 | 3 | 7 | 5 | 8 |
| 19 | 1 | 10 | 11 | 11 |
| 19 | 3 | 5 | 7 | 11 |
| 46 | 4 | 9 | 10 | 6 |

| F. | I. | '' | ''' | '''' |
|---|---|---|---|---|
| 28 | 4 | 3 | 7 | 10 |
| 36 | 10 | 3 | 11 | 4 |
| 19 | 10 | 4 | 7 | 6 |
| 39 | 5 | 6 | 9 | 4 |
| 47 | 6 | 2 | 10 | 11 |
| 92 | 11 | 10 | 3 | 7 |

A joiner having finiſhed ſeveral very curious pieces of workmanſhip, would know the contents of the whole; now the firſt piece meaſured ſeventeen feet, ten inches, two ſeconds, and one third; the ſecond meaſured twenty feet four inches, and ſeven thirds: the third forty-nine feet, ſix inches, and nine ſeconds; the fourth fourſcore feet, and ten ſeconds; the fifth ſeventeen feet and four thirds; the ſixth threeſcore feet, and ten ſeconds; and the ſeventh thirty-ſeven feet, and nine thirds;—what was the contents in ſquare meaſure?

## *Subtraction of Duodecimals.*

### EXAMPLES.

| | F. | I. | ″ | ‴ | ⁗ | | F. | I. | ″ | ‴ | ⁗ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *From* | 74 | 3 | 4 | 7 | 6 | | 100 | 5 | 7 | 3 | 1 |
| *Take* | 19 | 4 | 1 | 8 | 10 | | 97 | 8 | 9 | 10 | 11 |

A joiner having lined ſeveral rooms very curiouſly, with cedar, finds the amount to be, in ſquare meaſure 800 f. 3 in. 4″; but ſeveral deductions being to be made for windows, arches, &c. thoſe deductions amounted to 76 f. 3 in. 7″ 10‴ 5⁗:—how many feet of workmanſhip muſt be paid for?

## *Multiplication of Duodecimals, commonly called Croſs Multiplication.*

*Note,* Feet multiplied by feet give feet.
Feet multiplied by inches give inches.
Feet multiplied by ſeconds give ſeconds.
Inches multiplied by inches give ſeconds.
Inches multiplied by ſeconds give thirds.
Seconds multiplied by ſeconds give fourths, &c.

Examples.

| | *F.* | *I.* | |
|---|---|---|---|
| *Multiply* | 7 | 3 | |
| *By* | 4 | 7 | |
| | 29 | 0 | " |
| | 4 | 2 | 9 |
| *Product* | 33 | 2 | 9 |

1. *Of feet and inches.*

1. Here I multiply 7 f. 3 in. firſt by four feet (which give feet and inches for the product) ſaying 4 times 3 is 12. ſet down 0 and carry 1; then 4 times 7 is 28 and 1 is 29, which ſet down.

2. Next I multiply the ſame 7 f. 3 in. by 7 inches (which gives inches and ſeconds for the product) ſaying 7 times 3 is 21, ſet down 9 ſeconds and carry 1 inch; then 7 times 7 is 49 and 1 is 50 inches, or 4 feet, 2 inches, which ſet down; then add them together, and the whole is 33 f. 2 in. 9 ſec.

| | *F.* | *I.* | | *F.* | *I.* | | *F.* | *I.* | | *F.* | *I.* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Multiply* | 7 | 5 | | 4 | 6 | | 9 | 7 | | 8 | 3 |
| *By* | 3 | 9 | | 5 | 8 | | 9 | 7 | | 0 | 4 |
| *Product* | 27 | 9 | 9 | 25 | 6 | | 91 | 10 | 1 | 52 | 4 |

| | *F.* | *I.* | | *F.* | *I.* | | *F.* | *I.* | |
|---|---|---|---|---|---|---|---|---|---|
| *Multiply* | 4 | 7 | | 3 | 8 | | 9 | 7 | |
| *By* | 5 | 10 | | 7 | 6 | | 3 | 6 | |
| *Product* | 26 | 8 | 10 | 27 | 6 | | 32 | 6 | 6 |

| | *F.* | *I.* | | *F.* | *I.* | | *F.* | *I.* | |
|---|---|---|---|---|---|---|---|---|---|
| *Multiply* | 3 | 11 | | 6 | 5 | | 7 | 10 | |
| *By* | 9 | 5 | | 7 | 6 | | 8 | 11 | |
| *Product* | 36 | 10 | 7 | 48 | 1 | 6 | 69 | 10 | 2 |

The truth of any one of theſe operations may be proved by reducing the factors into inches, and dividing their product by 144, the number of ſquare inches in a foot ſquare, the quotient will be the anſwer, viz.

Firſt Sum.

1. *By whole numbers.*

*F.* *I.* *I.*
7 3 = 85
4 7 = 55

435
435

144)4785(33
432

465
432

33
12

144)396(2
288

108
12

144)1296(9
1296

0

2. *By Vulgar Fractions.*

*F.*
*Multiply* $7\frac{3}{12}$
*By* $4\frac{7}{12}$

$\frac{87}{12} \times \frac{55}{12} = \frac{4785}{144}$

Then divide the numerator by the denominator, as before.

3. *By Decimals.*

*Mult.* 4.5833+
*By* 7.25

229165
91666
320831

33.228925
12

2.747100
12

8.9652

*F.* *I.* ″
*Facit* 33 2 9 *nearly.*

*Note*, When the number of feet happens to be large in either or both of the factors, inſtead of multiplying by inches, (if any be) you may take parts with them.

EXAMPLES.

*F.* *I.*
*Multiply* 76 7
*By* 48 9

76×8 = 608
76×4 = 304
48×7 = 28 ''''.
$6\frac{1}{2}$) 38 3 6
$3\frac{1}{2}$) 19 1 9

*Product* 3733 5 3

*F.* *I.*
46 7
39 8

1847 9 8

*F.* *I.*
76 7
19 10

1518 10 10

*F.* *I.*
71 7
84 6

6048 9 6

*F.* *I.*
36 1
18 8

673 6 8

| | F. | I. | | F. | I. | | F. | I. | |
|---|---|---|---|---|---|---|---|---|---|
| *Multiply* | 84 | 3 | | 48 | 7 | | 79 | 8 | |
| *By* | 95 | 2 | | 26 | 8 | | 38 | 11 | |
| *Product* | 8017 | 9 | 6 | 1295 | 9 | 8 | 3100 | 4 | 4 |

| | F. | I. | | F. | I. | | F. | I. | |
|---|---|---|---|---|---|---|---|---|---|
| *Multiply* | 117 | 6 | | 767 | 5 | | 7691 | 10 | |
| *By* | 184 | 8 | | 198 | 3 | | 1976 | 11 | |
| *Product* | 23545 | 0 | | 152140 | 4 | 3 | 15206113 | 6 | 2 |

### 2. *Of Feet, Inches, and Seconds.*

| | F. | I. | " | | |
|---|---|---|---|---|---|
| *Multiply* | 7 | 3 | 2 | | |
| *By* | 1 | 7 | 3 | | |
| | 7 | 4 | 2 | ''' | |
| | 4 | 2 | 10 | 2 | '''' |
| | | 1 | 9 | 9 | 6 |
| *Product* | 11 | 7 | 9 | 11 | 6 |

| F. | I. | " | | F. | I. | " |
|---|---|---|---|---|---|---|
| 8 | 6 | 9 | | 3 | 10 | 6 |
| 7 | 3 | 8 | | 7 | 4 | 8 |
| 62 | 6 | 7 | 9 | 28 | 7 | 7 |

| F. | I. | " | | | F. | I. | " | | | F. | I. | " | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 1 | 9 | | | 3 | 8 | 4 | | | 9 | 8 | 7 | | |
| 7 | 8 | 9 | | | 3 | 9 | 2 | | | 12 | 3 | 10 | | |
| 55 | 2 | 9 | 3 | 9 | 13 | 10 | 10 | 4 | 8 | 119 | 8 | 2 | 10 | 10 |

| F. | I. | " | | | F. | I. | " | | | F. | I. | " | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 8 | 7 | | | 3 | 2 | 1 | | | 5 | 6 | 7 | | |
| 6 | 5 | 4 | | | 2 | 3 | 4 | | | 8 | 9 | 10 | | |
| 62 | 7 | 3 | 9 | 4 | 7 | 2 | 8 | 11 | 4 | 48 | 11 | 2 | 8 | 10 |

*Note,* If the number of feet is large, inſtead of multiplying by inches and ſeconds, you may take parts with them.

EXAMPLES.

| | F. | I. | ″ | ‴ | ⁗ |
|---|---|---|---|---|---|
| *Multiply* | 76 | 3 | 9 | | |
| *By* | 84 | 7 | 11 | | |
| 76 × 4 = | 304 | 0 | 0 | | |
| 76 × 8 = | 608 | 0 | 0 | | |
| 3 × 84 | 21 | 0 | 0 | | |
| 9 × 84 | 5 | 3 | 0 | | |
| *I.* $6\frac{1}{2}$) | 38 | 1 | 10 | 6 | |
| $1\frac{1}{6}$) | 6 | 4 | 3 | 9 | |
| ″$6\frac{1}{2}$) | 3 | 2 | 1 | 10 | 6 |
| $3\frac{1}{2}$) | 1 | 7 | 0 | 11 | 3 |
| $2\frac{1}{3}$) | 1 | 0 | 8 | 7 | 6 |
| *Product* | 6460 | 7 | 1 | 8 | 3 |

| F. | I. | ″ | | |
|---|---|---|---|---|
| 87 | 3 | 4 | | |
| 18 | 1 | 7 | | |
| 1582 | 6 | 2 | 3 | 4 |

| F. | I. | ″ | | |
|---|---|---|---|---|
| 64 | 3 | 7 | | |
| 27 | 2 | 6 | | |
| 1749 | 5 | 5 | 11 | 6 |

| F. | I. | ″ | | |
|---|---|---|---|---|
| 49 | 3 | 1 | | |
| 48 | 1 | 2 | | |
| 2369 | 1 | 5 | 7 | 2 |

| F. | I. | ″ | | |
|---|---|---|---|---|
| 71 | 3 | 6 | | |
| 92 | 1 | 7 | | |
| 6568 | 2 | 10 | 6 | 6 |

| F. | I. | ″ | |
|---|---|---|---|
| 71 | 2 | 6 | |
| 81 | 1 | 8 | |
| 5777 | 9 | 2 | 2 |

| F. | I. | ″ | |
|---|---|---|---|
| 56 | 1 | 8 | |
| 97 | 3 | 9 | |
| 5463 | 0 | 2 | 3 |

| F. | I. | ″ | |
|---|---|---|---|
| 756 | 1 | 8 | |
| 184 | 2 | 6 | |
| 139287 | 1 | 0 | 2 |

| F. | I. | ″ | | |
|---|---|---|---|---|
| 371 | 2 | 6 | | |
| 181 | 1 | 9 | | |
| 67242 | 10 | 1 | 4 | 6 |

| F. | I. | ″ | | |
|---|---|---|---|---|
| 487 | 11 | 10 | | |
| 186 | 10 | 11 | | |
| 91209 | 4 | 2 | 2 | 2 |

## *A Decimal Table of Inches and Seconds.*

| *I.* | *S.* | *Decimals* | *I.* | *S.* | *Decimals* | *I.* | *S.* | *Decimals* | *I.* | *S.* | *Decimals* |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 1 | .006944 | 1 | 1 | .099277 | 2 | 1 | .173611 | 3 | 1 | 256944 |
|  | 2 | .013888 |  | 2 | .097222 |  | 2 | .180555 |  | 2 | .263888 |
|  | 3 | .020833 |  | 3 | .104166 |  | 3 | .1875 |  | 3 | .270833 |
|  | 4 | .027777 |  | 4 | .111111 |  | 4 | .194444 |  | 4 | .277777 |
|  | 5 | .034722 |  | 5 | .118055 |  | 5 | .201388 |  | 5 | .284722 |
|  | 6 | .041666 |  | 6 | .125 |  | 6 | .208333 |  | 6 | .291666 |
|  | 7 | .048611 |  | 7 | .131944 |  | 7 | .215277 |  | 7 | .298611 |
|  | 8 | .055555 |  | 8 | .138888 |  | 8 | .222222 |  | 8 | .305555 |
|  | 9 | .0625 |  | 9 | .145833 |  | 9 | 229166 |  | 9 | .3125 |
|  | 10 | .069444 |  | 10 | .152777 |  | 10 | .236111 |  | 10 | .319444 |
|  | 11 | .076388 |  | 11 | .159722 |  | 11 | .243055 |  | 11 | .326388 |
| 1 | 0 | .083333 | 2 | 0 | 166666 | 3 | 0 | .25 | 4 | 0 | .333333 |
| *I.* | *S* | *Decimals* | *I.* | *S.* | *Decimals* | *I.* | *S.* | *Decimals* | *I.* | *S.* | *Decimals* |
| 4 | 1 | .340277 | 5 | 1 | .423611 | 6 | 1 | .506944 | 7 | 1 | .590277 |
|  | 2 | .347222 |  | 2 | .430555 |  | 2 | .513888 |  | 2 | .597222 |
|  | 3 | .354166 |  | 3 | .43765 |  | 3 | .520833 |  | 3 | .604166 |
|  | 4 | .361111 |  | 4 | .444444 |  | 4 | .527777 |  | 4 | .611111 |
|  | 5 | .368055 |  | 5 | .451388 |  | 5 | .534722 |  | 5 | .618055 |
|  | 6 | .375 |  | 6 | .458333 |  | 6 | .541666 |  | 6 | .624999 |
|  | 7 | .381944 |  | 7 | .465277 |  | 7 | .548611 |  | 7 | .631944 |
|  | 8 | .388888 |  | 8 | .472222 |  | 8 | .555555 |  | 8 | .638888 |
|  | 9 | .395833 |  | 9 | .479166 |  | 9 | .5625 |  | 9 | .645833 |
|  | 10 | .403777 |  | 10 | .486111 |  | 10 | .569444 |  | 10 | .652777 |
|  | 11 | .409722 |  | 11 | .493055 |  | 11 | .576388 |  | 11 | .659722 |
| 5 | 0 | .416666 | 6 | 0 | .5 | 7 | 0 | .583333 | 8 | 0 | .666666 |
| *I.* | *S.* | *Decimals* | *I.* | *S.* | *Decimals* | *I.* | *S.* | *Decimals* | *I.* | *S.* | *Decimals* |
| 8 | 1 | .673611 | 9 | 1 | .756944 | 10 | 1 | .840277 | 11 | 1 | .923611 |
|  | 2 | .680555 |  | 2 | .763888 |  | 2 | .847222 |  | 2 | .930555 |
|  | 3 | .6857 |  | 3 | .770833 |  | 3 | .854166 |  | 3 | .9375 |
|  | 4 | .694444 |  | 4 | .777777 |  | 4 | .861111 |  | 4 | .944444 |
|  | 5 | .701388 |  | 5 | .784722 |  | 5 | .868055 |  | 5 | .951388 |
|  | 6 | .708333 |  | 6 | .791666 |  | 6 | .874999 |  | 6 | .958333 |
|  | 7 | .715277 |  | 7 | .798611 |  | 7 | .881944 |  | 7 | .895277 |
|  | 8 | .722222 |  | 8 | .805555 |  | 8 | .888888 |  | 8 | .972222 |
|  | 9 | .729166 |  | 9 | .8125 |  | 9 | .895833 |  | 9 | .979166 |
|  | 10 | .736111 |  | 10 | .819444 |  | 10 | .902777 |  | 10 | .986111 |
|  | 11 | .743055 |  | 11 | .826388 |  | 11 | .909722 |  | 11 | .993055 |
| 9 | 0 | .75 | 10 | 0 | .833333 | 11 | 0 | .916666 | 12 | 0 | .1 |

## *The Conſtruction of the foregoing* TABLE.

Let it be required to find what part of a foot one ſecond is in Decimals.

1. One foot reduced into ſeconds, makes 144 ſeconds.

2. The vulgar fraction will then be $\frac{1}{144}$ of a foot.

3. Divide the upper term by the lower, and the quotient thence ariſing will be the anſwer.

```
144)1.000000(.006944+
       864
       ----
       1360
       1296
       -----
         640
         576
         ---
          640
          576
          ---
           64
```

After the ſame manner the whole table is made except in the caſe of inches only; as in the caſe of one inch, where the vulgar fraction will be $\frac{1}{12}$ of a foot. Divide the upper term by the lower, as before, and you have the quotient for the anſwer.

```
12)1.000000).083333+
              4
```

*Note*, 1. If the given part of a foot conſiſts only of inches, the diviſor need be no more than 12, becauſe 12 inches make 1 foot.

2. If the given part of a foot conſiſts of ſeconds only, or inches and ſeconds together, then 144 muſt be the diviſor, becauſe 144 ſeconds make 1 foot.

### *The Uſe of the foregoing* TABLE.

Let the firſt example in multiplication be given, *viz.*

|  | *F.* | *I.* |
|---|---|---|
| *Multiply* | 7 | 3 |
| *By* | 4 | 7 |

Look in the table for 3 inches, againſt which ſtands .25.— Again, look for 7 inches, againſt which ſtands .583333.—Hence it follows, that 7 f. 3 in. = 7.25 f. and 4 f. 7 in. = 4.583333 f.

Note, It is common in any large number of decimals, to ſave trouble in the operation, by making one of them one part larger, which cuts off all the following ſigures; thus 4.58333 f. may be made 4.584 f.

```
           F.
Multiply 7.25
     By 4.584
     --------
         2900
        5800
       3625
      2900
     --------
     33.23400
           12
     --------
        2.808
           12
     --------
        9.696
     ========
```

|  | *F.* | *I.* | ″ |
|---|---|---|---|
| *Anſ.* | 33 | 2 | 9 |

Again; Let the firſt example in feet, inches, and ſeconds be given, viz.

|  | *F.* | *I.* | ″ |
|---|---|---|---|
| *Multiply* | 7 | 3 | 2 |
| *By* | 1 | 7 | 3 |

Look in the table for 3 in. 2 ſec. and againſt them you will find .263888; alſo look in the ſame table for 7 in. 3 ſec. and againſt them you will find .604166; then by ſhortening the decimals,

*Multiply* 7.264
*By* 1.6041

7264
29056
43584
7264

11.6521824
12

7.82616
12

9.91392
12

10.96704
12

11.60448

F. I. ″ ‴ ⁗
*Ans.* 11 7 9 10 11 *the difference being inconſiderable.*

## *Diviſion of Duodecimals.*

| F. I, | ″ | F. | F. | I. | ″ |
|---|---|---|---|---|---|
| 2)146 | 7 | 10( | 73 | 3 | 11 |
| 3)761 | 4 | 11( | | | |
| 4)963 | 2 | 10( | | | |
| 5)186 | 1 | 10( | | | |
| 6) 76 | 3 | 11( | | | |
| 7)186 | 1 | 10( | | | |
| 8)712 | 8 | 4( | | | |
| 9)812 | 3 | 5( | | | |
| 10)861 | 11 | 10( | | | |

| F. | I. | ″ | | |
|---|---|---|---|---|
| 11)123 | 4 | 5( | | |
| 12) 76 | 8 | 7( | ‴ | ⁗ |
| 7) 86 | 3 | 7 | 4 | 8( |
| 8) 98 | 4 | 6 | 9 | 1( |
| 9) 86 | 2 | 1 | 1 | 7( |
| 10) 47 | 3 | 4 | 6 | 1( |
| 11) 96 | 2 | 7 | 11 | 4( |
| 12) 83 | 1 | 6 | 9 | 10( |
| 12) 78 | 10 | 11 | 10 | 9( |

Note 1. It very ſeldom happens that the diviſor conſiſts of more than one denomination; yet becauſe ſuch diviſors may ſometimes offer themſelves, I will give a few for the reader's ſatisfaction, which muſt be wrought after the manner of Long-Diviſion, and may ſerve alſo as proofs to ſome of the foregoing examples in Multiplication.

2. This ſort of diviſion often admits of two figures at once in the quotient

EXAMPLES.

*F. I. F. I.* " *F. I.*
*F. I.* 4 5)33 1 6)7 6
4 5 × 7 = 30 11
2 2 6
4 5 × 6 = 2 2 6
0

Note, If the feet in the quotient conſiſt of more than one ſigure, you muſt conſider,

1. How many figures are required in the feet by common diviſion.
2. If the feet required conſiſt only of two figures, you muſt multiply the diviſor by the firſt figure (which ſtands in tens place) with a cypher annexed. But,
3. If the feet required conſiſt of three figures, you muſt multiply the diviſor by the firſt figure (which ſtands in hundreds place) with two cyphers annexed; and the next figure in the quotient (which ſtands in tens place) with one cypher annexed.
4. Whatever the product is in feet and inches let it be placed under the dividend, in ſuch manner, that feet and inches may ſtand under feet and inches, and units under units.
5. With regard to the number of feet in the dividend, you muſt proceed according to the common method of long diviſion, till you have obtained the number of feet required in the quotient.

*F. I. F. I.* " *F. I.*
*F. I.* 184 8)235.45 0 0(127 6
184 8 × 100 = 184.66 8
507.8 4
184 8 × 20 = 369.3 4
1385 0
184 8 × 7 = 1292 8
92 4 0
184 8 × 6 *in.* = 92 4 0
0

*F. I. F. I.* " *F. I.*
*F. I.* 48 9)3733 5 3 (76 7
48 9 × 70 = 3412 6
370 11
48 9 × 6 = 292 6
28 5 3
48 9 × 7 *in.* = 28 5 3
0

| | | | | | | |
|---|---|---|---|---|---|---|
| F. | I. | F. | I. | " | F. | I. |
| 79 | 8) | 3100 | 4 | 4( | 38 | 11 |

F. I.
79 8 × 30 = 2390

7104
79 8 × 8 = 6374

73 0 4
79 8 × 11 = 73 0 4

0
=

| F. | I. | F. | I. | " |
|---|---|---|---|---|
| 6 | 7) | 31 | 3 | 3( |
| 8 | 10) | 87 | 7 | 2( |
| 8 | 9) | 83 | 10 | 3( |
| 12 | 9) | 130 | 8 | 3( |
| 11 | 5) | 140 | 9 | 8( |
| 9 | 3) | 116 | 4 | 9( |

| F. | I. | F. | I. | " |
|---|---|---|---|---|
| 39 | 8) | 1847 | 9 | 8( |
| 84 | 6) | 6048 | 9 | 6( |
| 19 | 10) | 1518 | 10 | 10( |
| 95 | 2) | 8017 | 9 | 6( |
| 26 | 8) | 1895 | 6 | 8( |
| 18 | 8) | 673 | 6 | 8( |

| F. | I. | " | F. | I. | " | ‴ | ⁗ | F. | I. | " |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7 | 3) | 11 | 7 | 9 | 11 | 6( | 7 | 3 | 2 |

11 2 9

5 0 11
4 9 9

3 2 6
3 2 6

0
=

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| F. | I. | " | F. | I. | " | ‴ | ⁗ |
|---|---|---|---|---|---|---|---|
| 7 | 3 | 8) | 62 | 6 | 7 | 9( | |
| 3 | 10 | 6) | 28 | 7 | 7 | 0( | |
| 7 | 1 | 9) | 55 | 2 | 9 | 3 | 9( |
| 3 | 9 | 2) | 13 | 12 | 10 | 4 | 8( |

| F. | I. | " | F. | I | " | ‴ | ⁗ |
|---|---|---|---|---|---|---|---|
| 12 | 3 | 10) | 119 | 8 | 2 | 10 | 10( |
| 9 | 8 | 7) | 62 | 7 | 3 | 9 | 4( |
| 3 | 2 | 1) | 7 | 2 | 8 | 11 | 4( |
| 8 | 9 | 10) | 48 | 11 | 2 | 8 | 10( |

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